The Demographics of Commuting in Greater Boston

Produced by the Central Transportation

Planning Staff for the Boston Metropolitan

Planning Organization

2nd Edition, Revised

Incorporating results of the 1990 U.S. Census

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THE DEMOGRAPHICS OF COMMUTING IN GREATER BOSTON

2ND EDITION, REVISED

INCORPORATING RESULTS OF THE 1990 U.S. CENSUS

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INTRODUCTION

Commuting is at the core of most of the issues of transportation, for it is the morning and afternoon peaks, the rush hours every weekday, which determine what the capacity of most of our roads and transit facilities should be.* The metropolitan transportation system as a whole must be able to serve the peak volume, not merely the average volume spread over an entire day. Thus, at the basis of any transportation plan must lie an understanding of the patterns of commuting in the metropolitan area. The object of this document is to explain the pattern of commuting seen in the Boston region today by looking at the area's demographic trends since 1950.

During the decades following the end of the Second World War, sweeping changes in land use and development occurred across the region. New zoning codes and the construction of new expressways served to open up large tracts of land to new housing development. Thousands of families pursued the "American Dream" to a suburban house and a new car, leaving behind the crowded, old cities. Later, jobs followed the people to the suburbs, as commercially zoned land (originally intended for warehouses) was developed for office parks. The effect of these two migrations was a tremendous increase in suburb-to-suburb commuting.

While suburban commuting might have led to less congestion in the region, as commuters shifted from crowded routes converging on the urban core to wide-open suburban roads, the amount of development that occurred in suburban areas soon overwhelmed the available road space. Because the style of most suburban development discourages ridesharing and mass transit, almost all suburb-to-suburb work trips occur in single-occupant vehicles. Highways which were intended as an alternative to congested urban roads soon became congested themselves, filled with cars carrying one person each, travelling from a suburban home to a suburban office.

Because Boston's urban core has remained a vital economic center during this period of suburban development, traffic congestion is seen throughout the region, on suburban highways and arterial roads as well as on routes to downtown. While mass transit is available to serve trips to the downtown area and thus mitigate congestion on the highways, there are few options for suburban commuters.

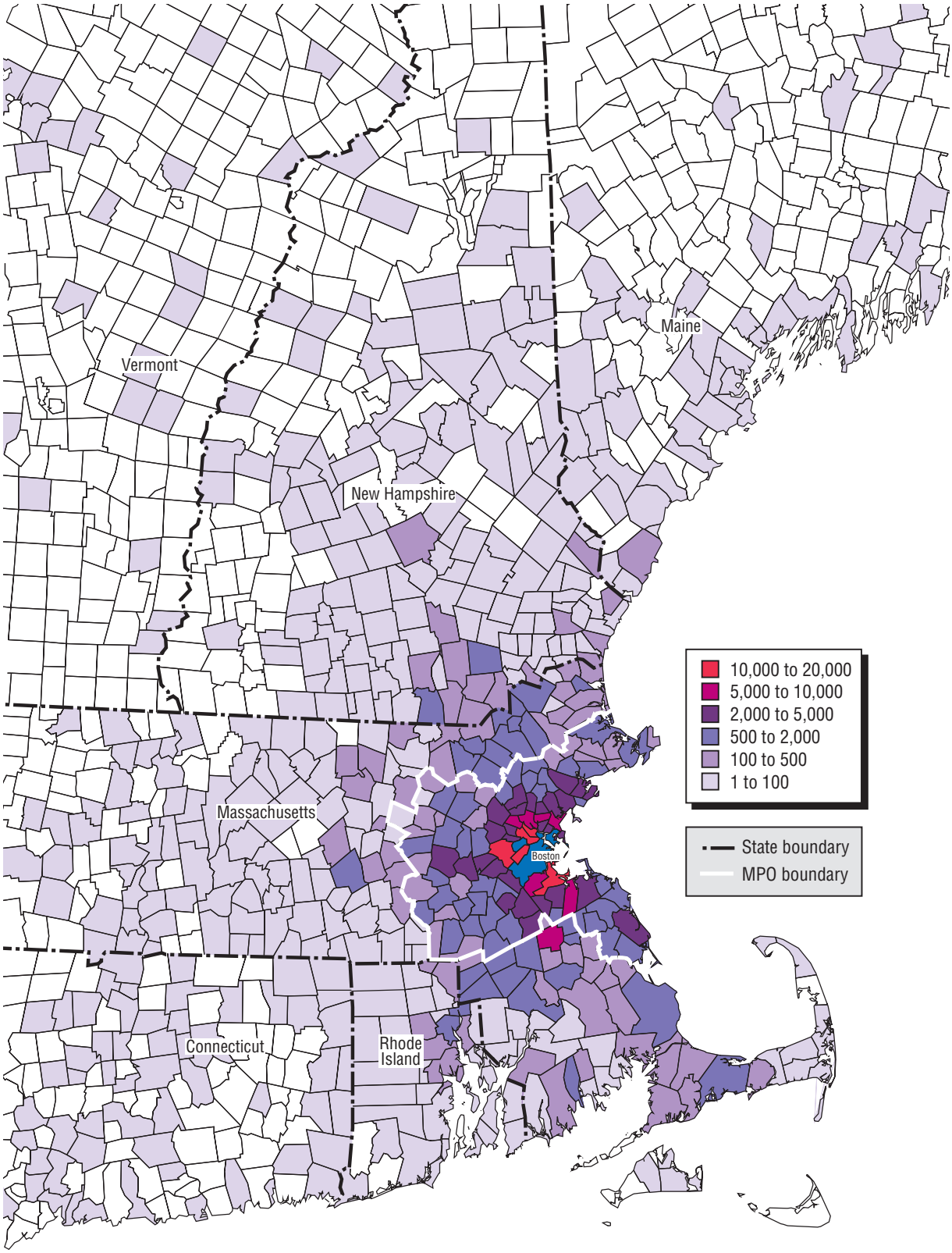
In attempting to shed some light on the forces which have shaped commuting in the Boston region, this document will first define an appropriate study area and then go on to examine trends in population, housing and employment. Following that portion of the analysis will be a study of actual commuting patterns, highlighting the differences between older cities and newly developed suburbs. Understanding these trends and patterns will be an aid to transportation planners and land use planners in creating policies to help reduce congestion, promote sustainable economic growth and enhance the quality of life for the people who live and work here.

*From the start, it must be recognized that work trips represent only a portion of travel. Data from the Nationwide Personal Transportation Survey (NPTS) show that in 1995 the traditional home-to-work trip accounted for only 18% of person trips. Even during rush hours, work trips account for less than one-third of all person trips. It is also the case, though, that many trips for other purposes (shopping, personal business, etc.) are done on the way to work. While these nonwork trips are counted as separate trips for the purpose of travel surveys such as the NPTS, their timing and routing are often determined by the home-to-work trip with which they form a "trip chain."

A second point to make is that weekend travel, especially that undertaken for recreational purposes, can, in some cases, be the determining factor in the appropriate size of a transportation facility. One example in the Boston region is Interstate 95 from Peabody to the New Hampshire border, which is usually more congested on weekends, with people returning from the mountains and the seashore, than on weekdays.

FIGURE 1

Number of Commuters to Boston, 1990



SOURCE: U.S. CENSUS BUREAU

CTPS

Boston is commonly known as the "Hub of New England," reflecting its status as the focus of the regional economy, built up over three and a half centuries of commerce and trade. Although many characteristics of the region have changed over that time span, the city of Boston still functions as the primary center of economic activity in New England.

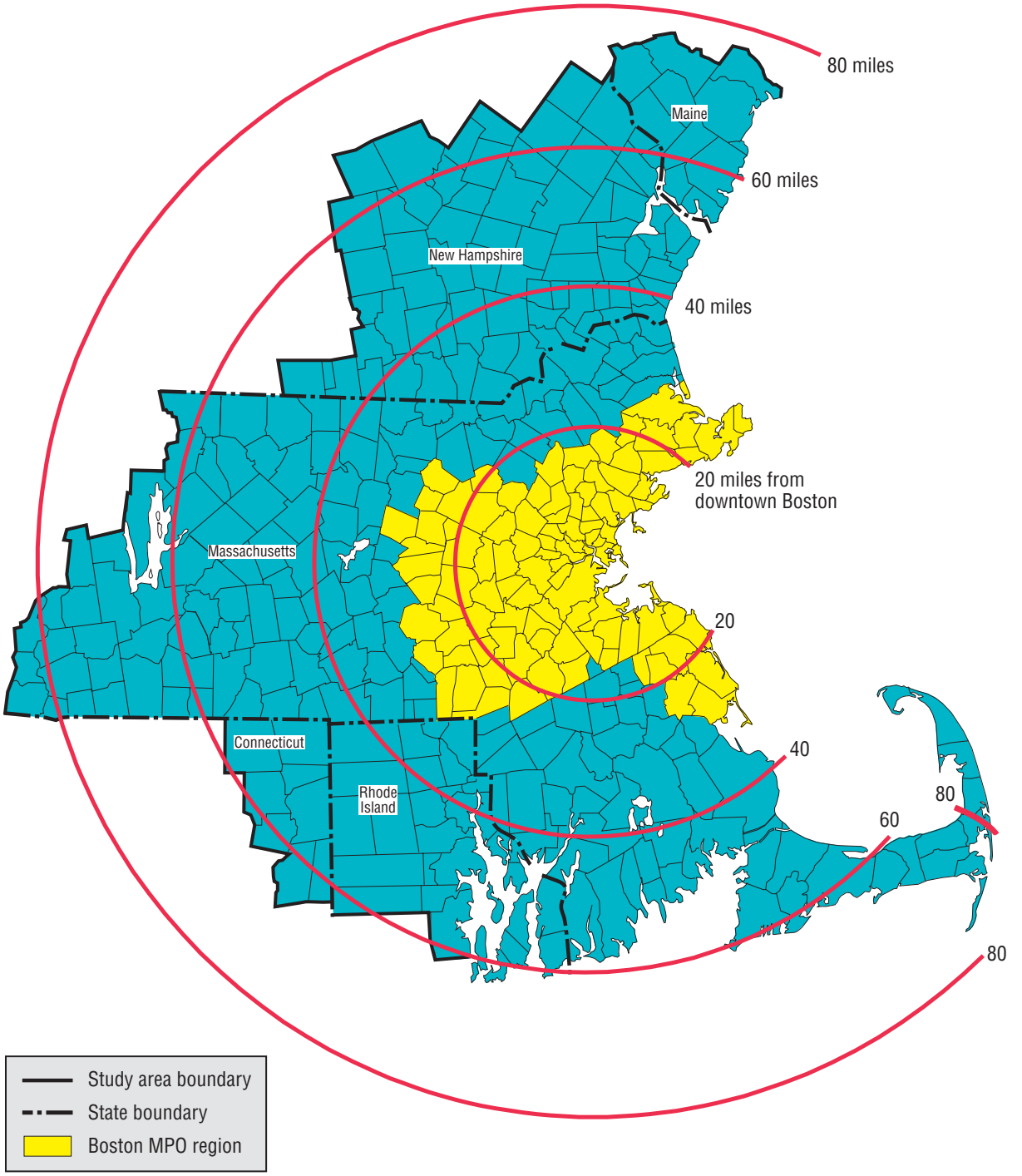
The reach of Boston's influence is manifested in the pattern of commuting of its workers. *FIGURE 1* displays the number of commuters to Boston in 1990 by community of residence. It is clear that Boston's commuters are not confined within the boundary of the Boston Metropolitan Planning Organization (MPO) region,* shown as a thick white line, or even within the state. Of the 500,000 total commuters to Boston, more than 50,000 people commuted from outside of the Boston MPO region, and of those, more than 10,000 commuted from out of state.†

*The MPO comprises fourteen entities, including state transportation agencies, regional authorities and agencies, and local governments.

†This map and others later in this report are based on the Journey-to-Work portion of the U.S. Census. The long form of the Census, sent to a random sample of the population, asks questions on the location of the respondent's workplace and the means of transport used to get to work. Data on commuting patterns are available from the last three Censuses: 1970, 1980 and 1990.

FIGURE 2

MPO Commuter Source Area



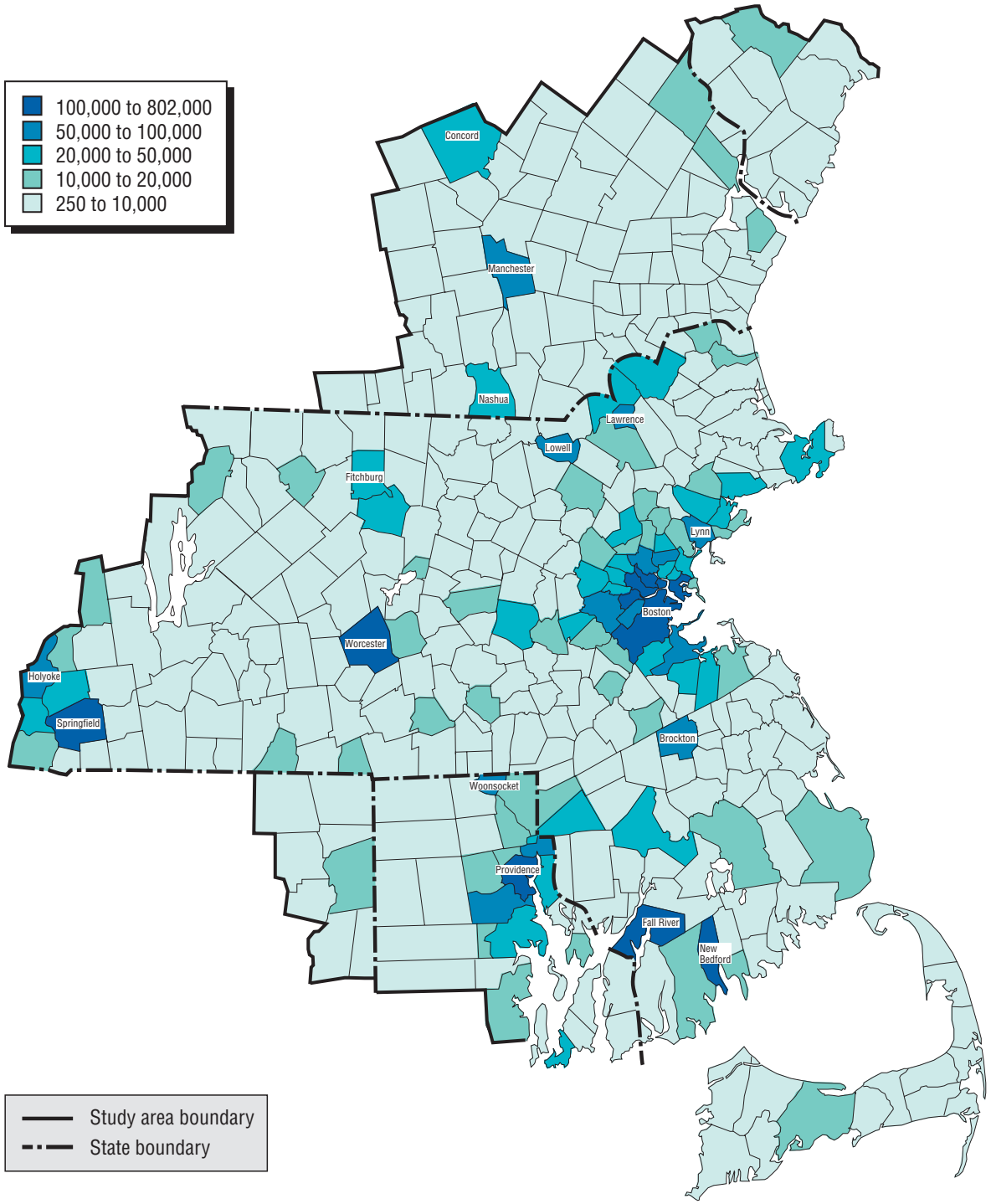
Because of the great extent of Boston's influence, in order to get a complete picture of commuting to workplaces in the Boston MPO region, it is necessary to study the large area shown in *FIGURE 2*. Roughly corresponding to a seventy-mile radius around Boston, it includes 388 cities and towns in five New England states. We will call it the MPO Commuter Source Area to reflect the fact that it encompasses the residences of virtually all of the people who work in the 101 cities and towns which make up the Boston MPO region.

The MPO Commuter Source Area is a very large region, home to nearly seven and a half million people—more than twice the population of the MPO region. It includes several metropolitan areas in Massachusetts—Worcester, Fall River, New Bedford, Brockton, Lowell, Lawrence, Haverhill and Fitchburg—plus Providence, Rhode Island, and Manchester, Nashua, Concord and Portsmouth, New Hampshire. Some of these metropolitan areas are completely contained within the MPO Commuter Source Area, some only partly contained; the important point is that these metropolitan regions are economically interdependent and not easily separable, especially with respect to transportation issues.

In this study, only the cities and towns of the Boston MPO region will be examined as work trip destinations. Future, larger-scale studies could investigate how the metropolitan areas interact with each other, with the goal of obtaining an even more comprehensive view of commuting in the region.

FIGURE 3

Population, 1950



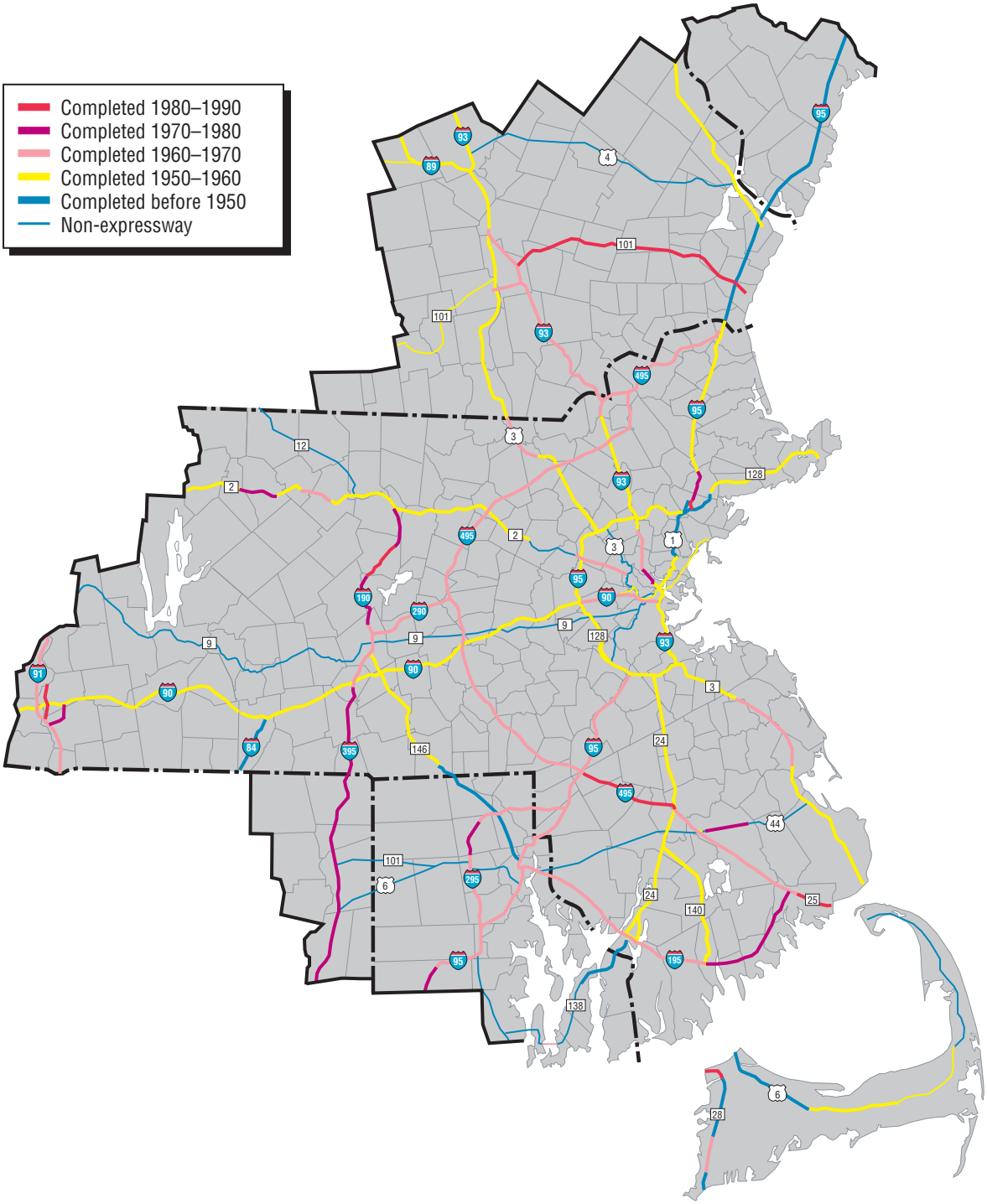
SOURCE: U.S. CENSUS BUREAU

CTPS

Our study of the Commuter Source Area begins with a survey of population shifts over the past forty years. Old urban centers dominated the population landscape in 1950, as the vast majority of the people were concentrated in large cities. *FIGURE 3* shows many of these old cities at the peak of their population and many of the towns on the South Shore and the area northwest of Boston not yet developed. Mass transit ridership in the urban areas was near its all-time high, although it was already beginning to decline as postwar prosperity and pent-up demand led to an explosion in automobile ownership. For people who commuted to Boston from the suburbs, commuter rail was the mode of choice, offering access times superior to those offered by the road network. In general, because there was no expressway network yet in place and because the automobile was not as pervasive as it is today, people's residences tended to be close to their jobs, which were concentrated in the cities. The region, however, was about to undergo a major transformation.

FIGURE 4

Construction of the Expressway Network



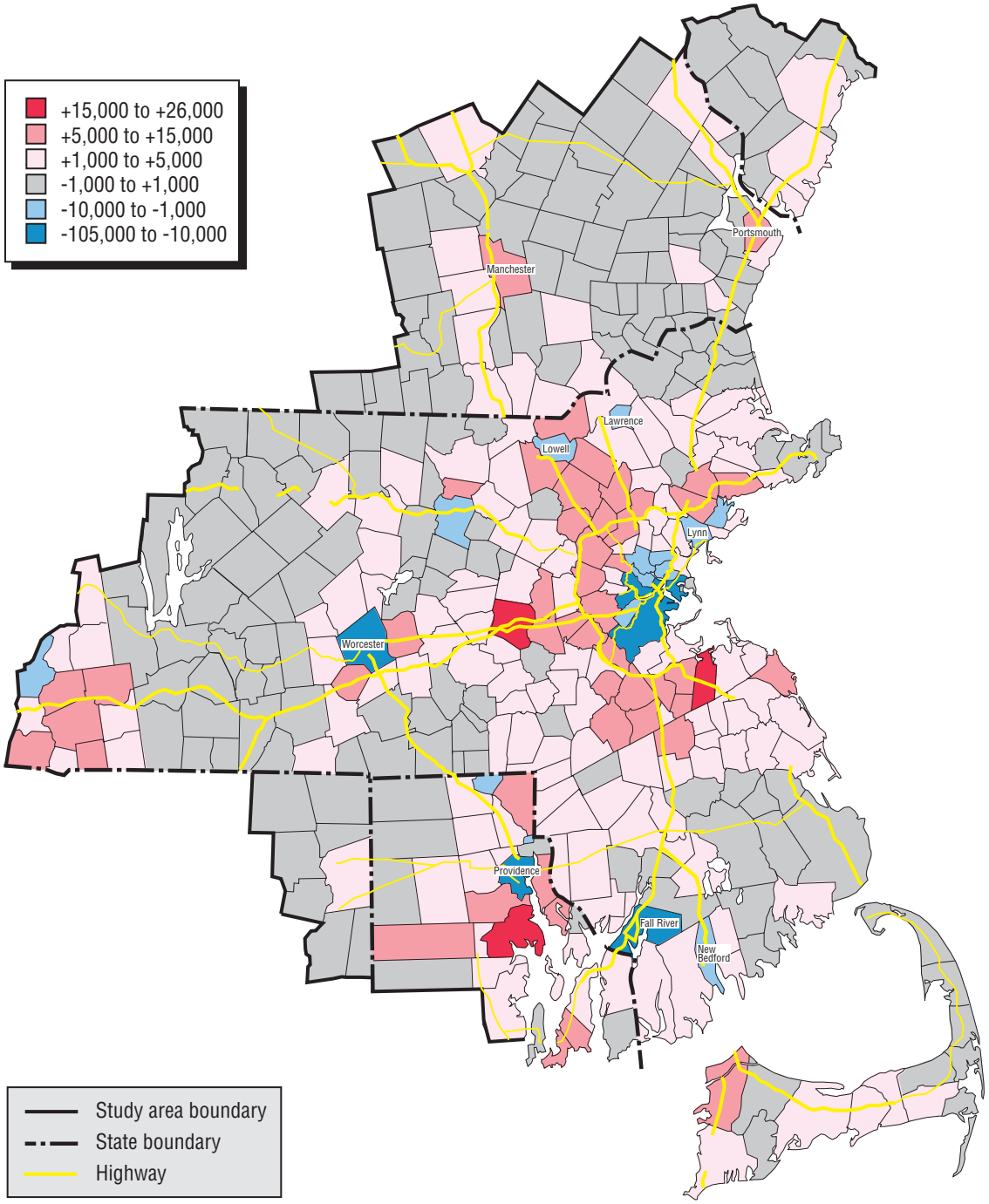
SOURCES: VARIOUS

CTPS

The years following the Second World War were the starting point for the construction of the regional expressway network, shown in *FIGURE 4*. Beginning in the 1950s with the construction of the Massachusetts Turnpike, Route 128 and the Central Artery, an extensive highway system was built, including both radial and circumferential routes. These roads provided good access to uncrowded and inexpensive land. With relatively few cars on the road (compared to today), suburban dwellers could have what many would call the best of all worlds: a job in the city, an inexpensive house with plenty of space in a nonurban neighborhood, and an easy commute in between.

FIGURE 5

Change in Population, 1950–1960



SOURCE: U.S. CENSUS BUREAU

CTPS

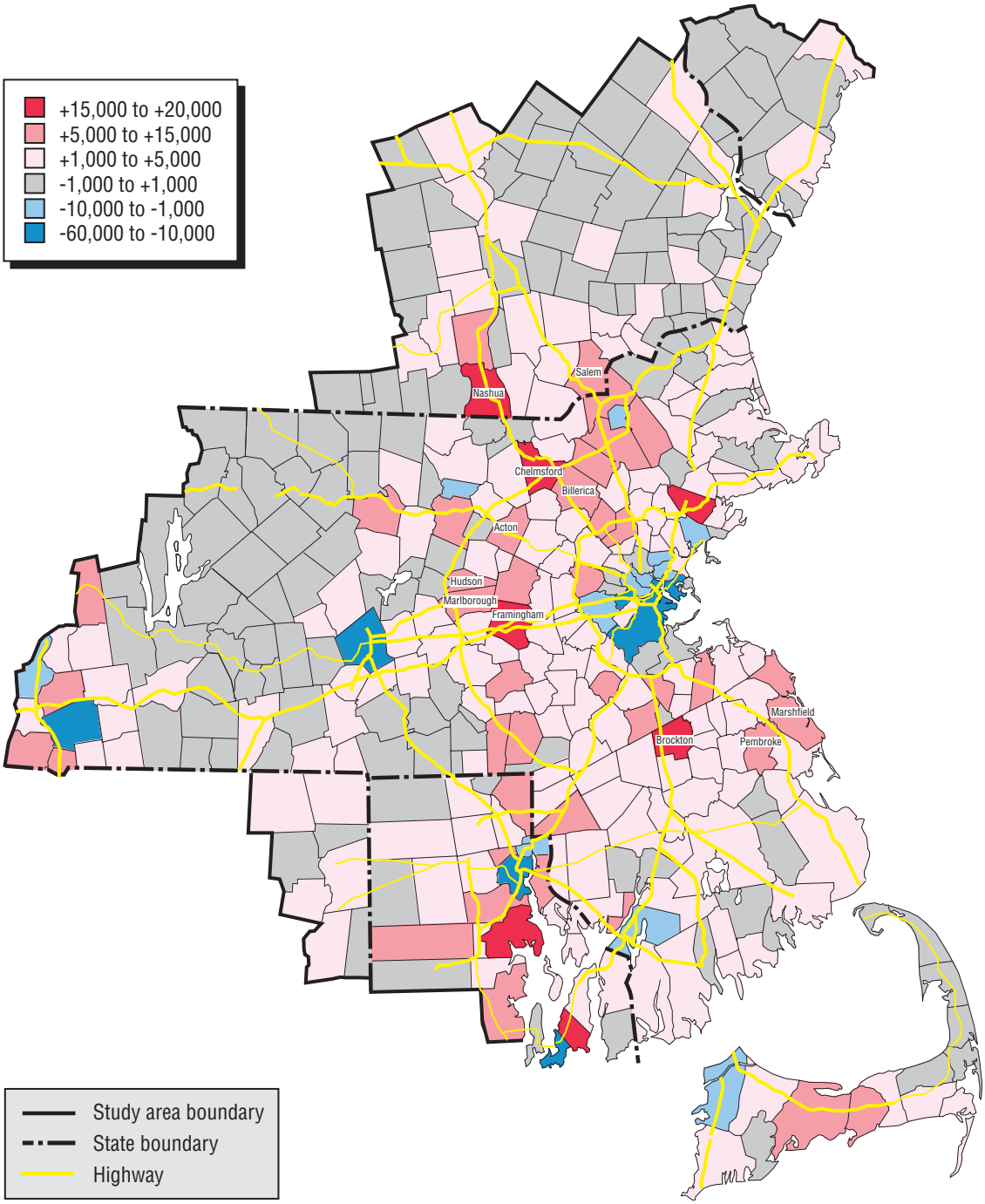
Indeed, a strong movement to the suburbs occurred in the 1950s and the following decades, as demonstrated in *FIGURE 5* and the next three maps. In the '50s, Boston's population suffered the steepest drop in its history, declining from over 800,000 to below the 700,000 mark by 1960. Across the region, suburban flight took its toll on the older cities such as Worcester, Providence, New Bedford, Fall River, Lowell, Lawrence and Lynn, all of which declined in population. In each case the urban center's loss was coupled with growth in the immediately surrounding suburbs. New Hampshire, in contrast, appears to have been immune to this trend, as Manchester and Portsmouth exhibited large increases in population.

The most striking feature of this map is the alignment of the towns showing growth along the recently completed highways, especially Route 128. (Only highways completed in 1960 are shown on the map.) Virtually all towns that gained at least 5,000 are near one of the new highways.

Without discussing in detail the reasons why people moved to the suburbs, it is very clear that the growth in the suburbs could not have occurred to nearly the extent it did if the highway network had not been built. The access provided by the highways was a crucial factor both in developers' decisions to build new housing in the suburbs and in families' decisions to move into those new houses.

FIGURE 6

Change in Population, 1960–1970



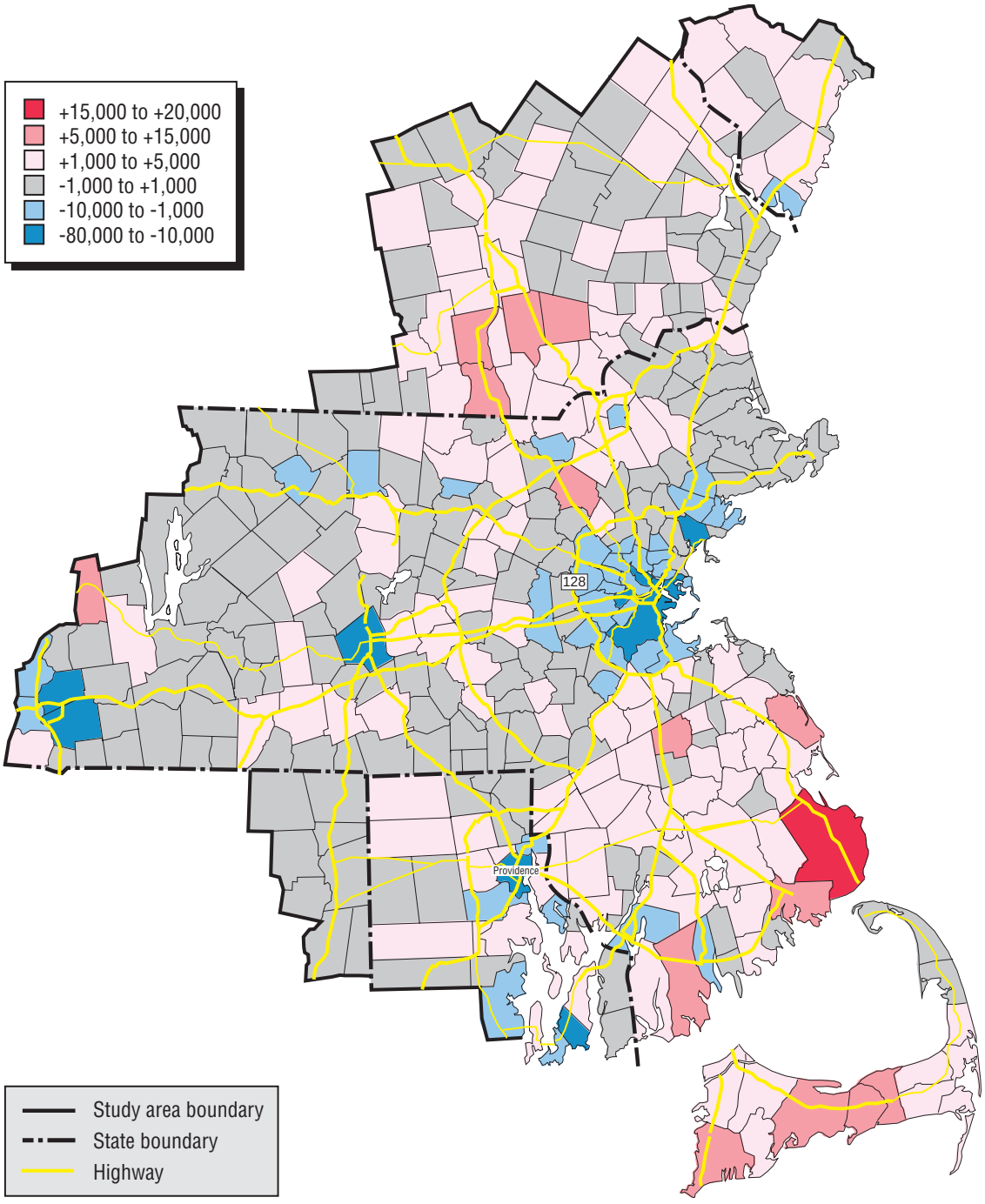
SOURCE: U.S. CENSUS BUREAU

CTPS

In the 1960s, suburban flight continued but with an important difference, shown in *FIGURE 6*. Although the towns along Route 128 continued to grow, the fastest increases occurred in towns further removed from the core. As more of the highway network was put into place, specifically the last segment of Route 3 to the south of Boston, Route I-93 north of Boston and parts of Route I-495, the next "ring" experienced rapid growth, including Marshfield, Pembroke, Brockton, Framingham, Marlborough, Hudson, Acton and the line of towns from Chelmsford and Billerica extending up to Salem, New Hampshire.

FIGURE 7

Change in Population, 1970–1980



SOURCE: U.S. CENSUS BUREAU

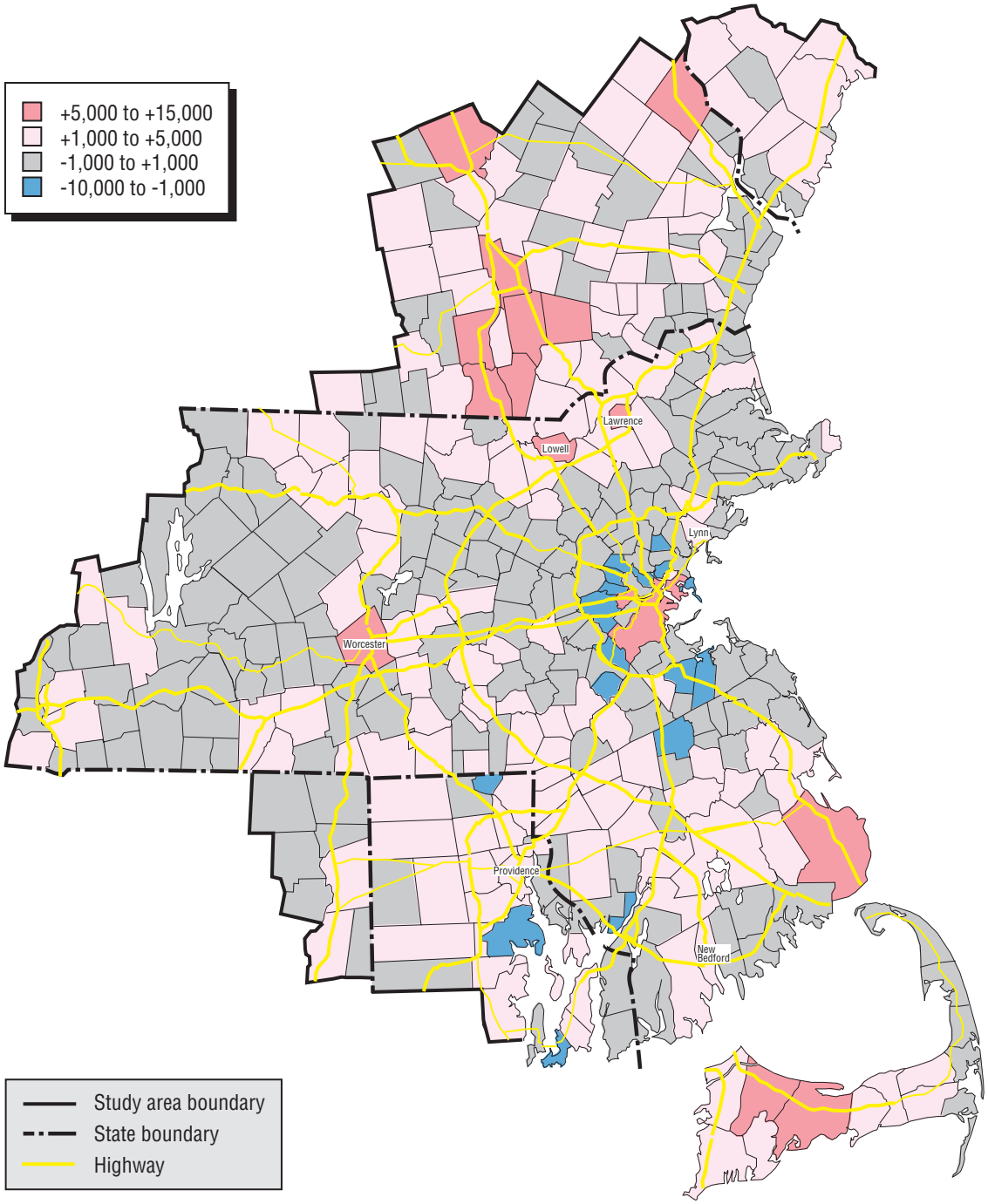
The population drain from the cities continued into the 1970s, but in this decade almost all of the suburbs within Route 128 joined Boston on the downhill slope. The zones of fastest growth seem to be mostly restricted to the northwest and southeast corners of the Commuter Source Area (see *FIGURE 7*), as most of the towns outside of 128 which had grown strongly in the '50s and '60s stabilized in the 1970s. Rhode Island seems to be self-contained in terms of population change, with Providence losing people and some of the surrounding towns picking up the slack. Southern New Hampshire and the Cape (including southern Plymouth County), however, do not seem to be self-contained, as there were no rapidly declining population centers in their midst. Rather, the growth of these two corners was tied, in part, to the decline of the inner core of Boston and its nearest suburbs. U.S. Census data show that significant numbers of Massachusetts residents emigrated to New Hampshire: between 1965 and 1970 more than 39,000 people had already done so, and between 1975 and 1980 more than 65,000 people made the journey northward.*

*This is not to imply that all of the population increase on the Cape and in southern New Hampshire represents former residents of Boston and the inner suburbs. While there has been an increase in commuting from the Cape to Boston—evidence of a direct link—and many Boston-area retirees have been moving to the Cape, a portion of the population increase there consists of workers and retirees from other parts of the country.

Furthermore, the population decline in the inner suburbs was by no means always a matter of whole households relocating to other areas. In some cases, households decreased in size as children grew up and moved out. In cases where a family did relocate, its dwelling may have been taken over by a childless couple or a single person. These phenomena are part of a well-documented trend of decreasing household size in urban areas.

FIGURE 8

Change in Population, 1980–1990



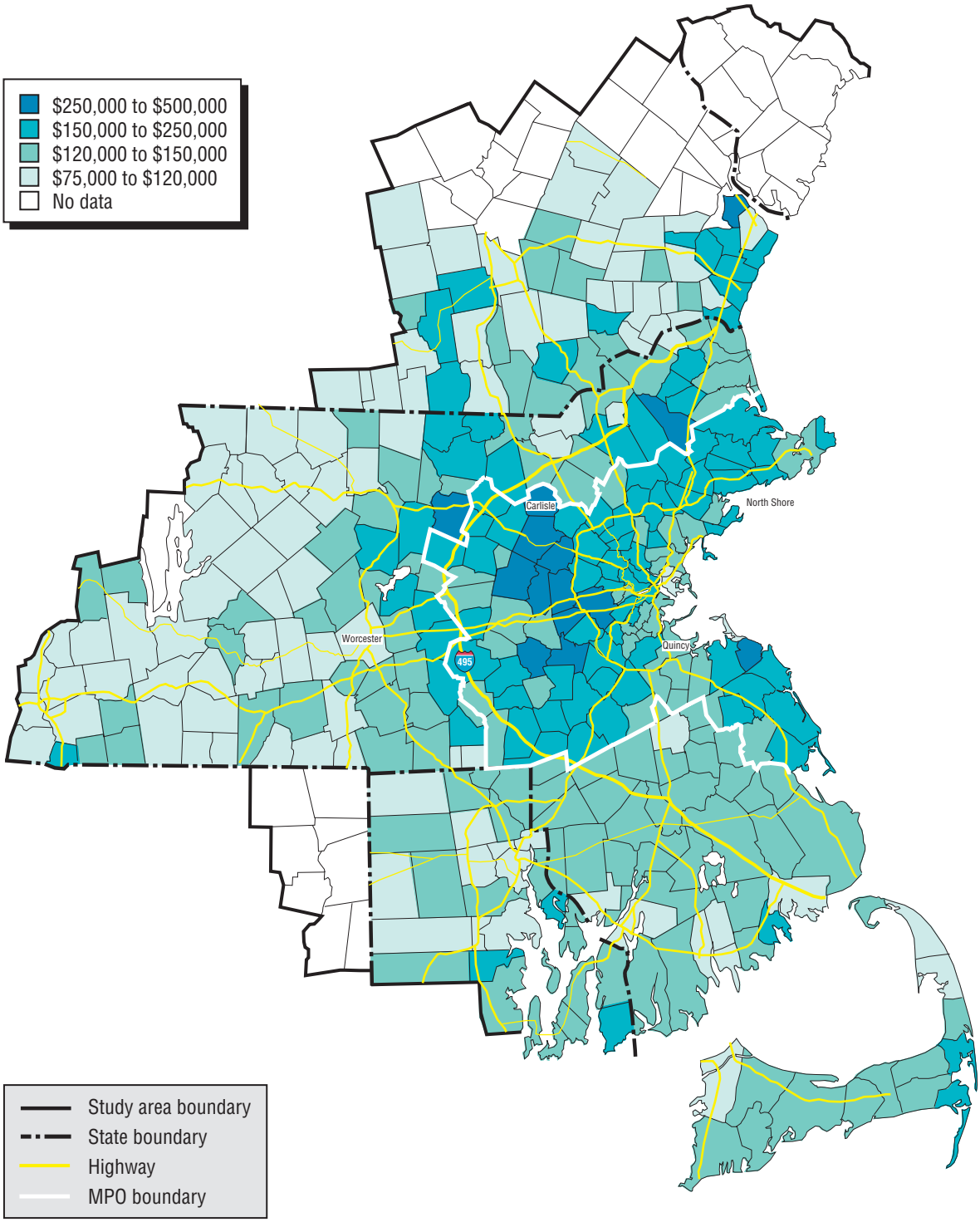
SOURCE: U.S. CENSUS BUREAU

In the '80s, as shown in *FIGURE 8*, most of the towns which had previously grown remained stable, while the towns at two of the corners of the area, northern Massachusetts/southern New Hampshire and the Cape, continued to grow. In general, population in the region was more stable in the '80s than in previous decades; no city or town experienced a loss of more than 10,000 people or a gain of more than 15,000. Some of the inner suburbs lost people, but Boston's population, having declined by more than 230,000 people since 1950, reversed itself and grew by nearly 12,000 during this decade. Most of the other old cities across the region also reversed their declines, with slight to moderate growth in Worcester, Lowell, Lawrence, Lynn, New Bedford and Providence.

The overall stability of the region during the 1980s coincides with the substantial completion of the regional highway system (see Figure 4). This is not to say that it was the relative lack of new highway construction that led to there being fewer population shifts. Rather, the stability of town-by-town population in the 1980s and the growth of the old cities indicate that the forces underlying the urban-to-suburban migration had largely spent themselves out by 1980.

FIGURE 9

Median Housing Price, 1990



SOURCES: COUNTY DATA CORPORATION, REAL DATA CORPORATION

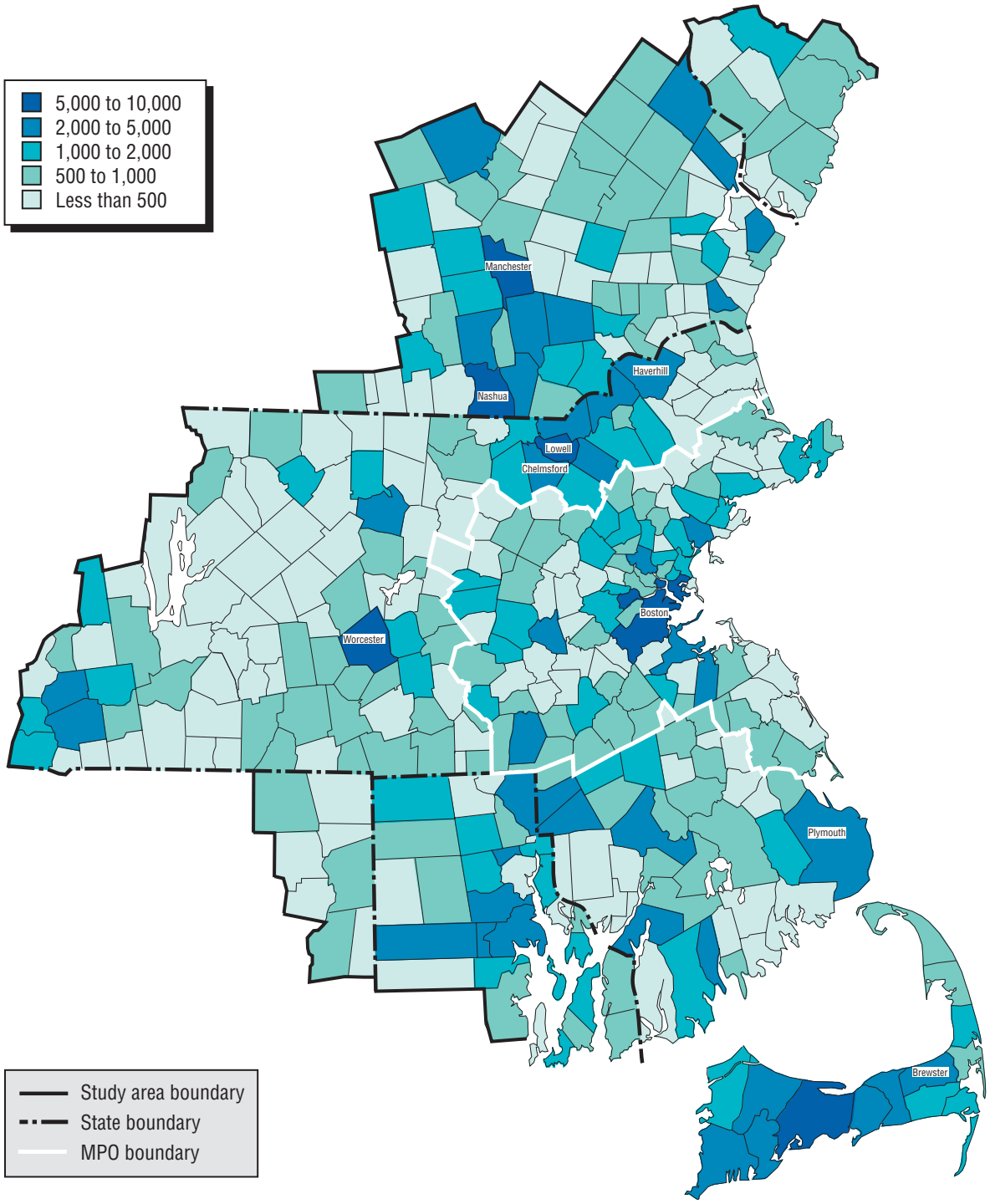
CTPS

The population changes that did occur during the 1980s can be related to the pattern of housing prices in the region. As shown in *FIGURE 9*, the 1990 median housing price of most of the towns within twenty miles of Boston was relatively high. With the exception of the city of Boston, the lower North Shore and the group of towns spreading southward from Quincy, the large majority of Boston MPO communities fell into the top two categories of housing price. Beyond I-495, most cities and towns were in the lower categories, with some exceptions in southern New Hampshire, particularly the coastal section. The mostly rural area to the west of Worcester exhibited very low prices.

Very few of the towns with the highest housing prices exhibited significant population growth; of those in the top price category, only Carlisle grew by more than 1,000 people. All of the cities and towns with a population increase greater than 5,000 belonged to the lower two categories of housing price.

FIGURE 10

Increase in Number of Housing Units, 1980–1990



SOURCE: U.S. CENSUS BUREAU

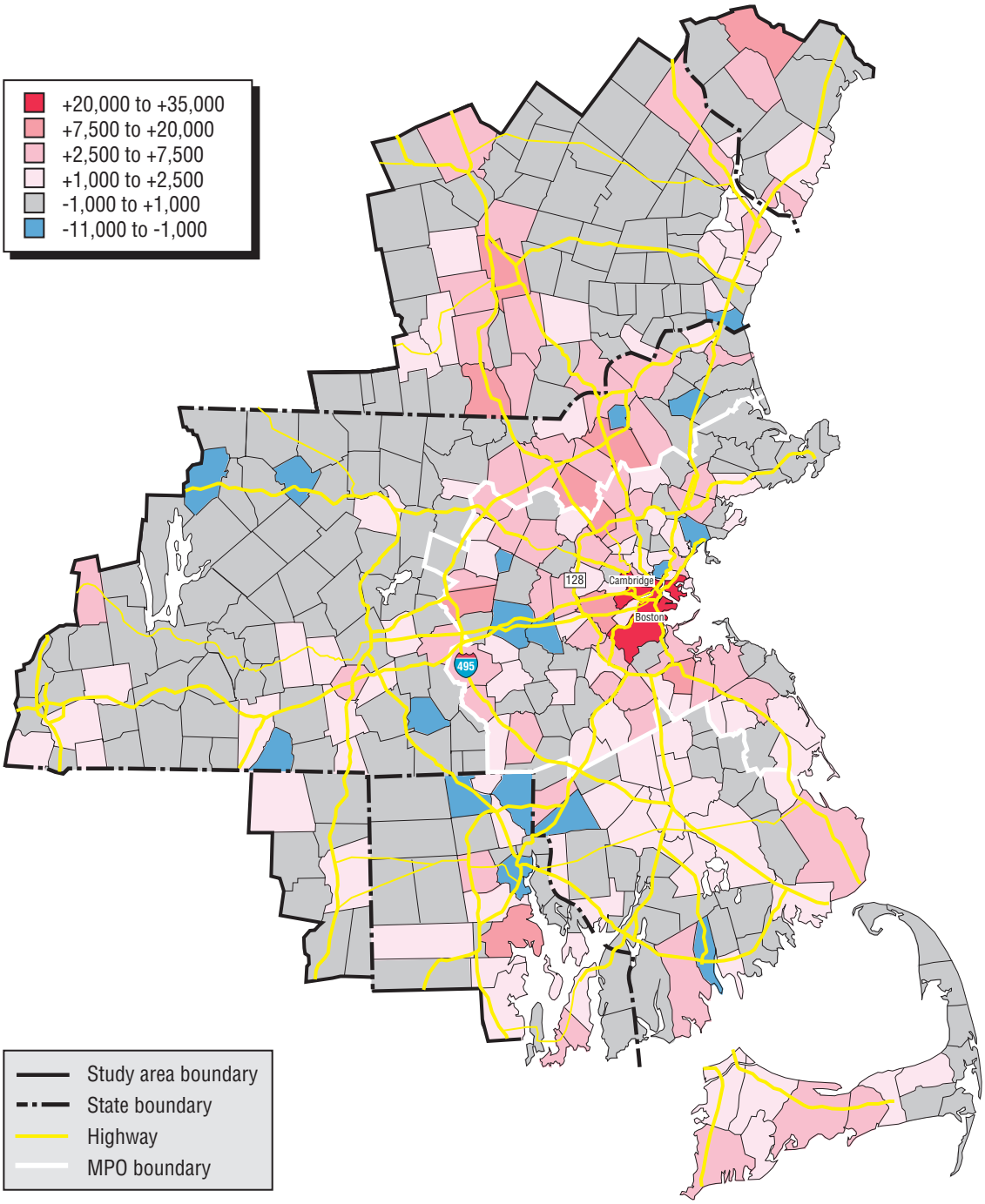
In a given city or town, both the price of housing and the number of inhabitants are intimately related to the supply of housing. Communities with high housing prices are likely to have few new units available and thus little growth in population; indeed, the high prices are a signal that the supply is constrained. Communities in which many new units are being built will generally have lower prices and greater population growth.*

FIGURE 10 shows that the supply of housing increased throughout the region from 1980 to 1990. The largest increases in supply occurred in old cities such as Boston, Worcester, Lowell, Nashua and Manchester, New Hampshire. These new units were mostly condominiums. Several smaller cities and towns, however, especially those at the corners of the Commuter Source Area, saw significant increases in their housing supply: from Chelmsford to Haverhill and into southern New Hampshire, and from Plymouth down the Cape to Brewster. Land in these places was cheap and available, allowing for the construction of many affordable new units. In contrast, the supply of housing in most of the MPO cities and towns increased at a slower pace.

*Some communities with a high turnover rate or net emigration may have low prices as well, even without new units being built.

FIGURE 11

Change in Number of Jobs, 1980–1990



SOURCE: U.S. CENSUS BUREAU

Access to jobs is one of the factors determining the demand for housing. Demand increased significantly during the 1980s because of the amount of employment growth in Boston and many other MPO cities and towns, shown in *FIGURE 11*. The high housing prices in most MPO communities (seen in Figure 9) were due, in part, to the slow growth in housing combined with the rapid employment growth.

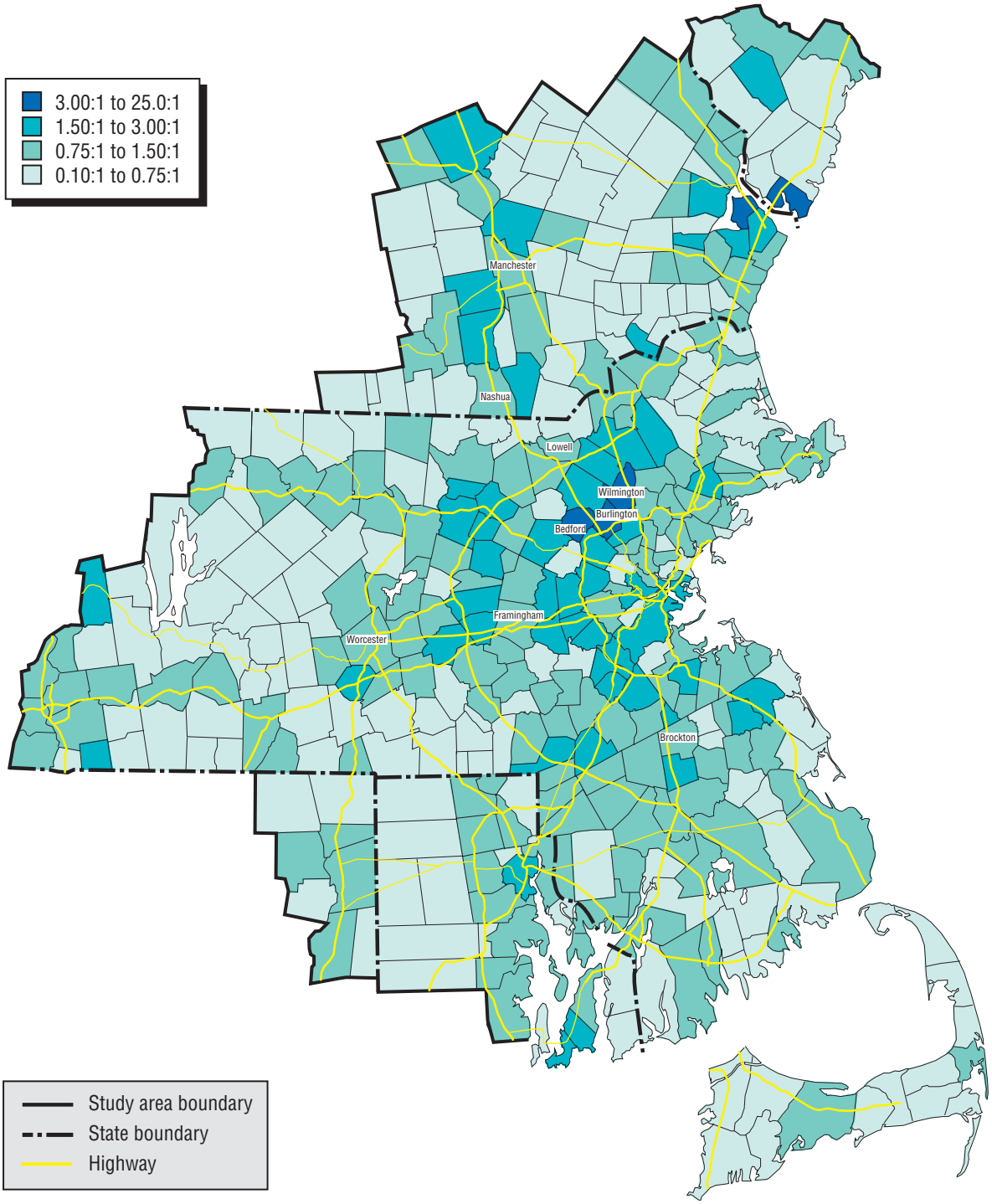
Boston expanded in its role of primary economic center with an increase of over 33,000 jobs (even taking into account the job loss during the recession at the end of the decade), and neighboring Cambridge expanded by nearly 21,000 jobs. The other ninety-nine cities and towns in the MPO region, however, gained over 200,000 jobs over the decade, overshadowing the growth of the two core cities. A large part of the growth occurred along Route 128, especially along its northwestern segment, and in towns stretching up toward I-495. This area, mainly because of its highway access, has been a location of choice for many of the high-tech firms which have been the driving force behind the Massachusetts economy.

Since the economic downturn of 1989 to 1992, job growth has resumed at a vigorous pace. Vacancy rates in downtown Boston are at near-record lows, and new development is occurring at many suburban locations. Town officials, in many cases, are eager for new commercial development because it increases the tax base for their town, yielding a boost in tax revenue above the strict limits imposed by Proposition 2 1/2.* In exchange for this increased revenue, though, the town and the region face the burden of added traffic on the local and regional road networks.

*This law, passed by referendum in 1980, limits the amount of money a city or town can collect by stating that the total property tax revenue in a given year may not be more than 2.5% greater than the previous year's total. The law also sets an absolute maximum levy of 2.5% of the total cash valuation of the property in the city or town. The only way to increase revenue above these limits, other than a referendum override, is by expanding the tax base through new development.

FIGURE 12

Ratio of Jobs to Housing Units, 1990



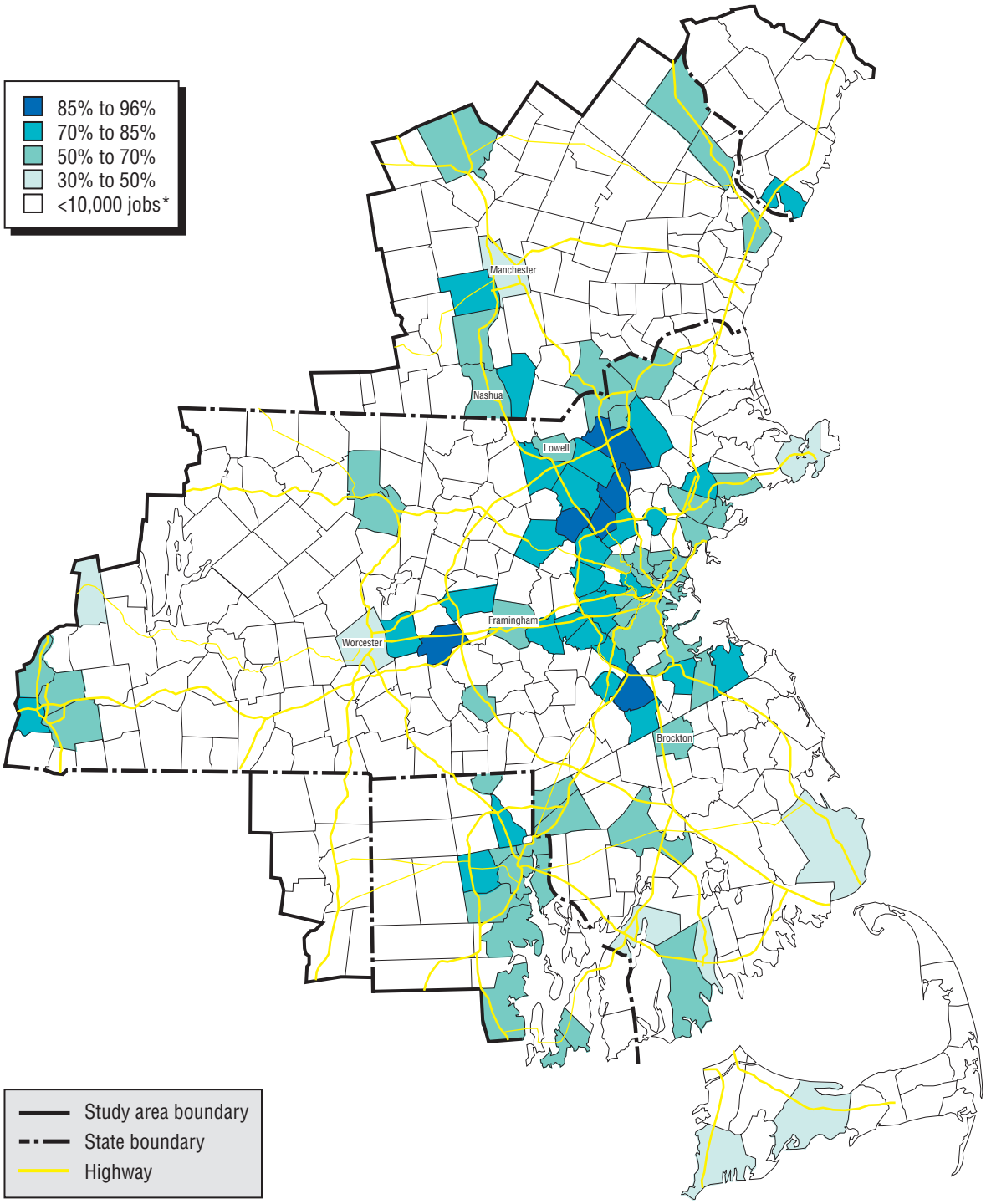
SOURCE: U.S. CENSUS BUREAU

While a great deal of job growth has occurred in the MPO region, Figure 10 showed that there has been comparatively little growth in housing units. Together, these trends have led to an imbalance of jobs and housing in many of the rising employment centers.* The ratio of jobs to housing units, shown in *FIGURE 12*, is very high in Bedford, Burlington and Wilmington, with four to five jobs for every housing unit. Most other Route 128 communities have moderately high ratios, as does the urban core. Several important employment centers, though, do not have an imbalance, including Worcester, Framingham, Brockton, Lowell, Nashua and Manchester, New Hampshire.

*The imbalance of jobs and housing is, in some cases, a result desired by town officials. While both commercial and residential development increase the tax base, the former has often been strongly favored. Commercial development is a more efficient generator of revenue because, for a given parcel of land, an office building will generally have a higher assessed valuation than a private home. Residential development, furthermore, can lead to higher expenses, as it increases the demand for local services: families with children need schools, and retirees often need special services.

FIGURE 13

Percentage of Workers Imported, 1990



*The percentage of workers imported is not shown for the cities and towns with fewer than 10,000 jobs.

SOURCE: U.S. CENSUS BUREAU

The same communities along and north of Route 128 which had high jobs/housing ratios imported at least 70% and in many cases over 85% of their workforce, as can be seen in *FIGURE 13*. Cities which had lower jobs/housing ratios imported smaller percentages of their workforce—between 50% and 70% for Brockton, Framingham, Lowell and Nashua, and less than 50% for Worcester and Manchester, New Hampshire.

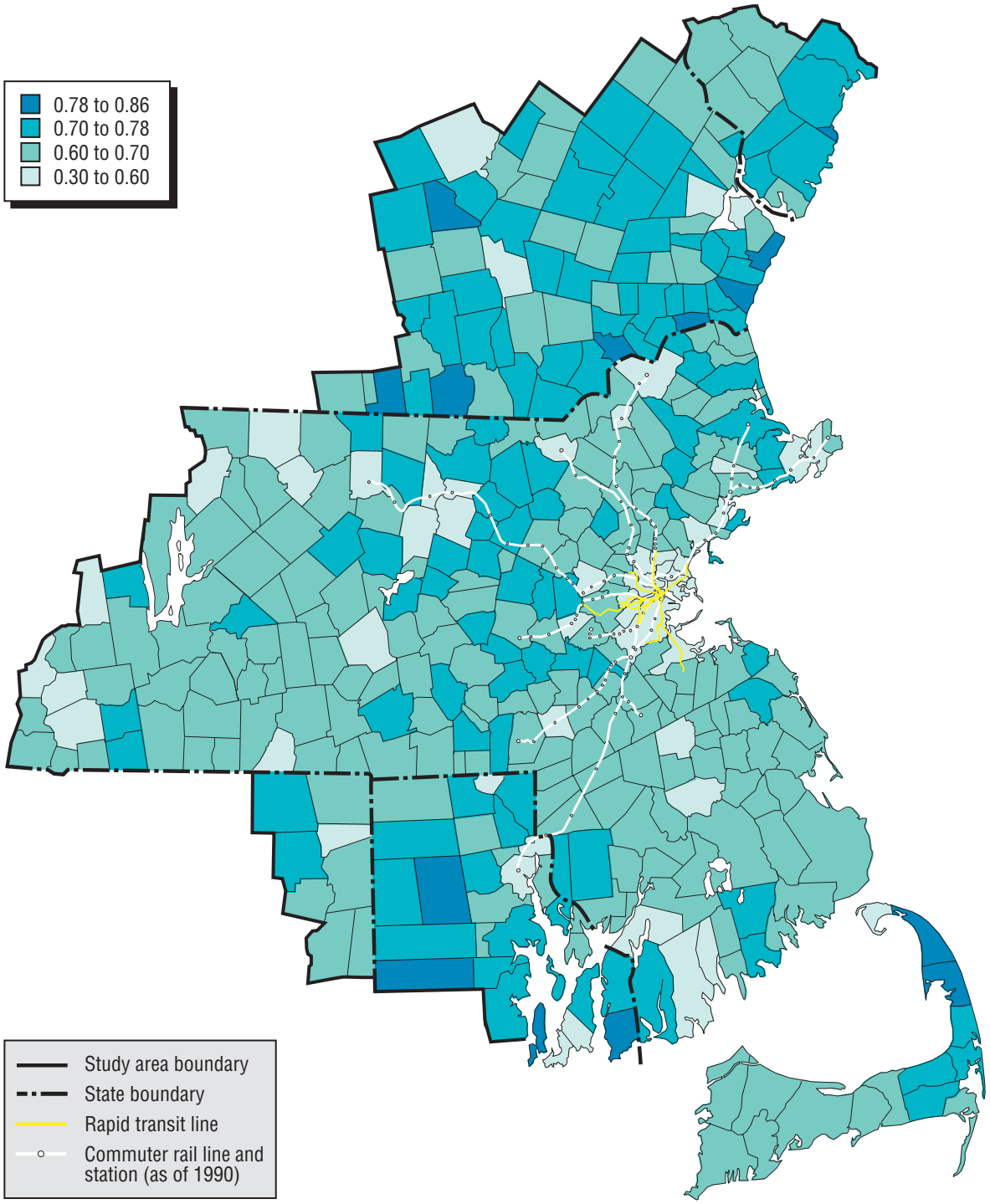
Of course, a high rate of importing workers does not necessarily imply that commuting distances are long. Given that many of the cities and towns in New England are small, and that the arbitrary boundary of the town line has little relevance to commuting, even if a town imports 80% of its workers, those workers could theoretically live in the surrounding towns and all commute under ten miles.

Boston, for example, exhibits an imbalance of jobs and housing and a moderately high percentage of imported workers. A good portion of Boston's housing deficit, though, is covered by the surrounding communities that have low jobs/housing ratios. Towns such as Milton, Brookline, Belmont, Arlington, Somerville and Medford provide homes for many employees of Boston. An even greater percentage of Boston employees could live relatively close (rather than up to seventy miles away) were it not for the fact that several of the communities along Route 128 can not function effectively as residence towns for Boston because they themselves have even worse deficits of housing.

The high rate of importing workers in some suburbs can lead to longer commutes, especially when the suburb is part of a cluster of towns with high ratios of jobs to housing. Burlington, for example, is not surrounded by bedroom communities but by other job centers with equally high jobs/housing ratios and high percentages of imported workers. Many of the workers of this northwest Route 128 area end up residing outside of I-495 and even beyond the Massachusetts border, having much longer commuting trips than they would have had if there had been more plentiful housing within the job cluster.

FIGURE 14

Motor Vehicles per Capita, 1990



SOURCE: U.S. CENSUS BUREAU

CTPS

The relative locations of jobs and housing help determine the patterns of commuting, but the ingredient that makes most of the patterns possible is the automobile. Unlike commuting to the urban core of Boston and Cambridge, for which there are several modal options (car, carpool, vanpool, commuter rail, bus, rapid transit, ferry), commuting to suburban workplaces almost always requires an automobile.

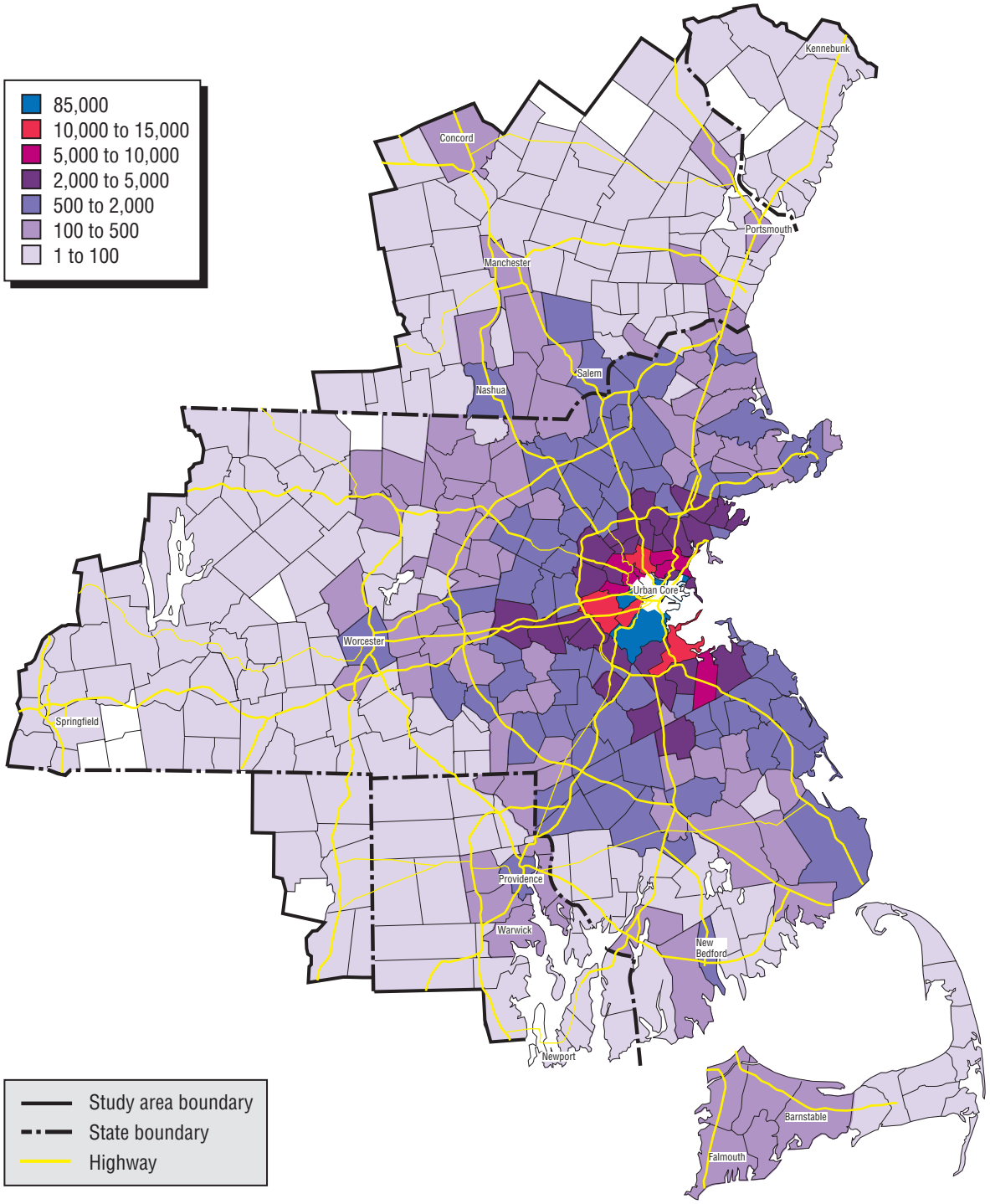
FIGURE 14 shows the number of motor vehicles per capita in 1990. In Massachusetts, there were 0.53 motor vehicles per capita, compared to the national average of 0.57, ranking the state fortieth in the nation. As is evident from the map, New Hampshire has significantly more vehicles per capita (0.67), followed by Maine (0.60) and Rhode Island (0.56).

The overlay of the rail transit system partly explains the lower level of vehicle ownership in Massachusetts. Every community served by a rapid transit line and the vast majority of those served by commuter rail lines fall into the bottom categories of vehicle ownership. The availability of alternative modes to travel to work (for those who work in the urban core) allows people living in these cities and towns to get by with one car or even none at all. Communities in the southeastern part of the state and the area from Worcester to the west exhibit low vehicle ownership partly because they are served by private carrier express bus routes (not shown on the map) and because they are less affluent than most of the towns in the eastern and northern parts of the state.

Even though Massachusetts residents currently own fewer vehicles on average than residents of other states, the number has been increasing. Since 1980, the number of motor vehicles per capita in Massachusetts has increased 16%. Some cities and towns have seen increases of up to 35%. While partly a result of higher incomes, the increased number of vehicles reflects the growing reliance on cars for commuting and other travel as people and jobs move away from transit-served areas.

FIGURE 15

Number of Commuters to the Urban Core, 1990



SOURCE: U.S. CENSUS BUREAU

While the study of population, housing and employment data can allow inferences about the patterns of commuting, Journey-to-Work data from the U.S. Census can provide direct verification of these inferences. Our analysis of these data will start with a study of the commuting pattern to the urban core and then move on to suburban job centers.

For the purposes of this study, the urban core is defined as an area made up of sections of the cities of Boston, Cambridge and Somerville.* This area is the same as the Central Artery/Tunnel Expanded Study Area used in the Central Artery project's land use projections.

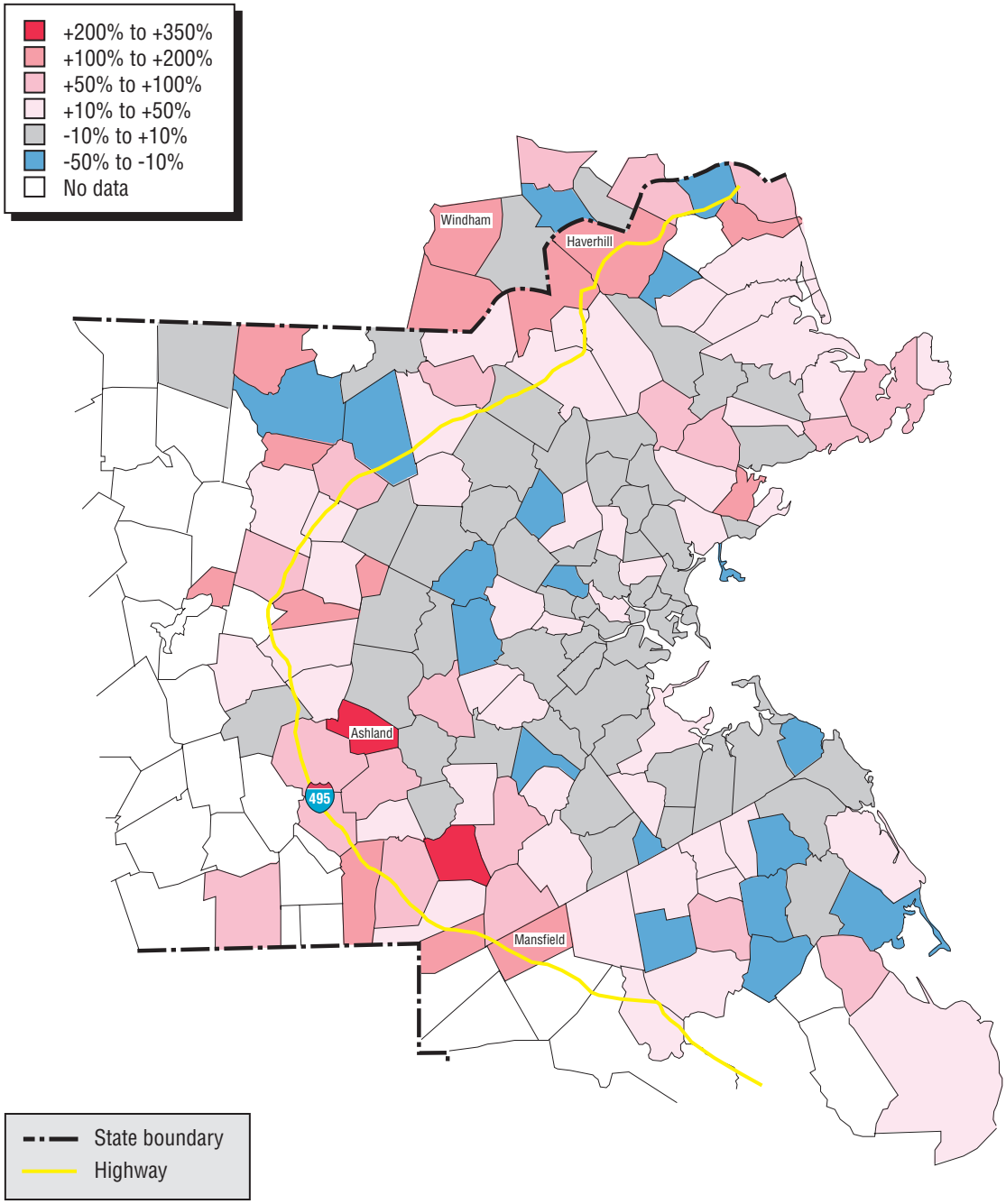
FIGURE 15 shows the number of commuters to the urban core in 1990. Out of a total of 500,000 jobs in the urban core, over 121,000 (24%) are filled by people who live in the urban core. The rest of Boston, Cambridge and Somerville contribute an additional 97,000 workers (19%). Other cities and towns immediately surrounding the urban core send in large numbers of workers: 144,000 (29%) from the twenty-seven other communities within Route 128. Between Route 128 and I-495, the numbers are smaller, but the slow rate at which they diminish demonstrates the extent of the influence of the urban core. Several communities beyond I-495—such as Providence, New Bedford, Worcester, Nashua and Salem, New Hampshire—each have more than 500 residents that commute to the urban core. Between 100 and 500 people commute from Falmouth and Barnstable; Warwick, Rhode Island; and Concord, Manchester and Portsmouth in New Hampshire—these commutes being nearly one and a half hours each way. Smaller numbers of people, in the range of 40 to 80, commute from as far away as Kennebunk, Maine; Springfield, Massachusetts; and Newport, Rhode Island.†

*Boston: Boston Proper (the Mass. Ave. peninsula), Charlestown, East Boston, Logan Airport, South Boston, South Bay, Lower Roxbury, Longwood, Fenway and Kenmore
Cambridge: MIT, East Cambridge/Lechmere, Cambridgeport, Central Square, Harvard Square, Porter Square and West Cambridge
Somerville: Spring Hill, East Somerville/Winter Hill, Boynton Yards

†Note that the Census asks for the location of the respondent's workplace during the previous week (which would be the last week of March 1990). Thus, some of these people shown commuting to the urban core may not have been "regular" commuters but people on business trips.

FIGURE 16

Percentage Change in Number of Commuters to the Urban Core, 1980–1990



SOURCE: U.S. CENSUS BUREAU

Looking at the changes in the commuting pattern to the urban core between 1980 and 1990, one finds a tendency toward lengthening commuting trips. *FIGURE 16* shows the percentage change in the number of commuters to the urban core for the central portion of the study area.* The majority of the close-in communities are in the "stable" category (i.e., less than 10% change up or down), while some of them experienced a significant decline. To find communities with rapid growth in the number of commuters to the urban core, one has to go out to the I-495 ring and beyond. Several of these more distant communities experienced a doubling or even a tripling in commuters to the urban core. The areas with the fastest growth are the southwestern stretch of I-495, between Ashland and Mansfield, and a cluster of towns near the Massachusetts–New Hampshire border from Haverhill to Windham.

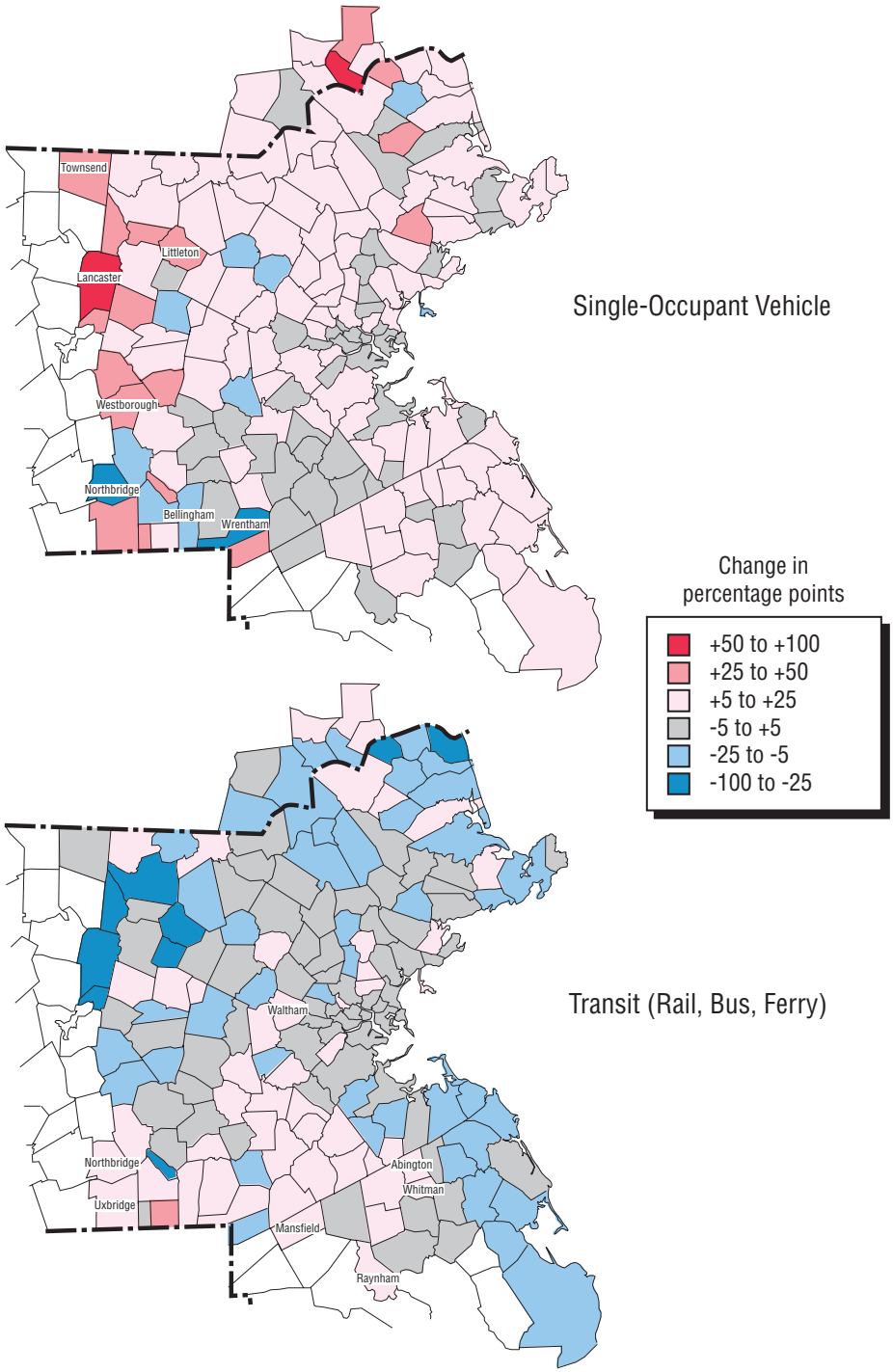
An increase in the number of commuting trips from distant locations combined with a decrease in trips from close-in locations yields an increase in the average trip length. Census data on work trip travel time support this conclusion, showing that the average work trip to the urban core increased from 29.1 minutes in 1980 to 31.1 minutes in 1990. For commuters who drove alone, the increase was even more significant, from 26.9 minutes to 30.4 minutes.†

*Data are unavailable for the rest of the study area.

†Other demographic trends offer possible explanations of why the length of commutes may be increasing in general. Although there are scant data to confirm it, it is generally acknowledged that job turnover rates are higher than in the past. Partly as a result of changing views about careers and company loyalty, but also due to the increasing flux in the business community stemming from downsizing and mergers, workers change jobs or at least job locations more frequently than in the past. Because the costs of residential relocation are high both financially, in terms of buying and selling a home, and with regard to family life, especially when children of school age are involved, housing transfers tend to lag behind job transfers, which increases the likelihood of a long commute. A second factor, for which there are more data, is the greater prevalence of dual-income households due to the increased participation of women in the labor force. The probability that both of the wage earners in a household would be employed in the same community is small, especially in view of the aforementioned trend, and therefore a long commute for one or both workers is not unlikely.

FIGURE 17

Change in Mode Share to the Urban Core, 1980–1990



SOURCE: U.S. CENSUS BUREAU

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While the change in number of commuters provides some perspective on shifts in commuting patterns, within a transportation context it is important to study trends in travel patterns for particular modes of travel. *FIGURE 17* contains two maps of the central portion of the study area showing the changes in mode shares between 1980 and 1990 for people who drive alone and people who use transit to reach the urban core. For urban core commuters living in the cities and towns shown in Figure 17, the mode share for single-occupant vehicles (SOVs) rose from 37.0% to 43.7% and the share for transit dropped from 34.4% to 33.5%.*

The upper map shows most of the cities and towns in the region experiencing an increase in the percent share for SOVs of between 5 and 25 points. Several towns to the west, bounded by Westborough, Lancaster, Littleton and Townsend, had somewhat larger shifts toward SOVs, increases up to and beyond 50 points.† Although there are a few scattered communities which saw the percentage of commuters driving alone drop during the '80s, the only portion of the region where this happened with any consistency was in the southwest, around Northbridge, Bellingham and Wrentham.

Looking at the lower map, this southwestern area can be seen as clearly different from the rest of the region. While most areas had a stable or moderately declining transit mode share, cities and towns stretching from Abington and Whitman north to Waltham, south to Raynham and Mansfield, and west to Uxbridge and Northbridge saw the percentage of their commuters to the urban core using transit rise by 5 to 25 points. Most of this increase occurred on commuter rail, due partly to improvements to the Franklin and Attleboro lines made during the 1980s, including new equipment, the improved Southwest Corridor, and the opening of a large park-and-ride facility at Forge Park/495 station.

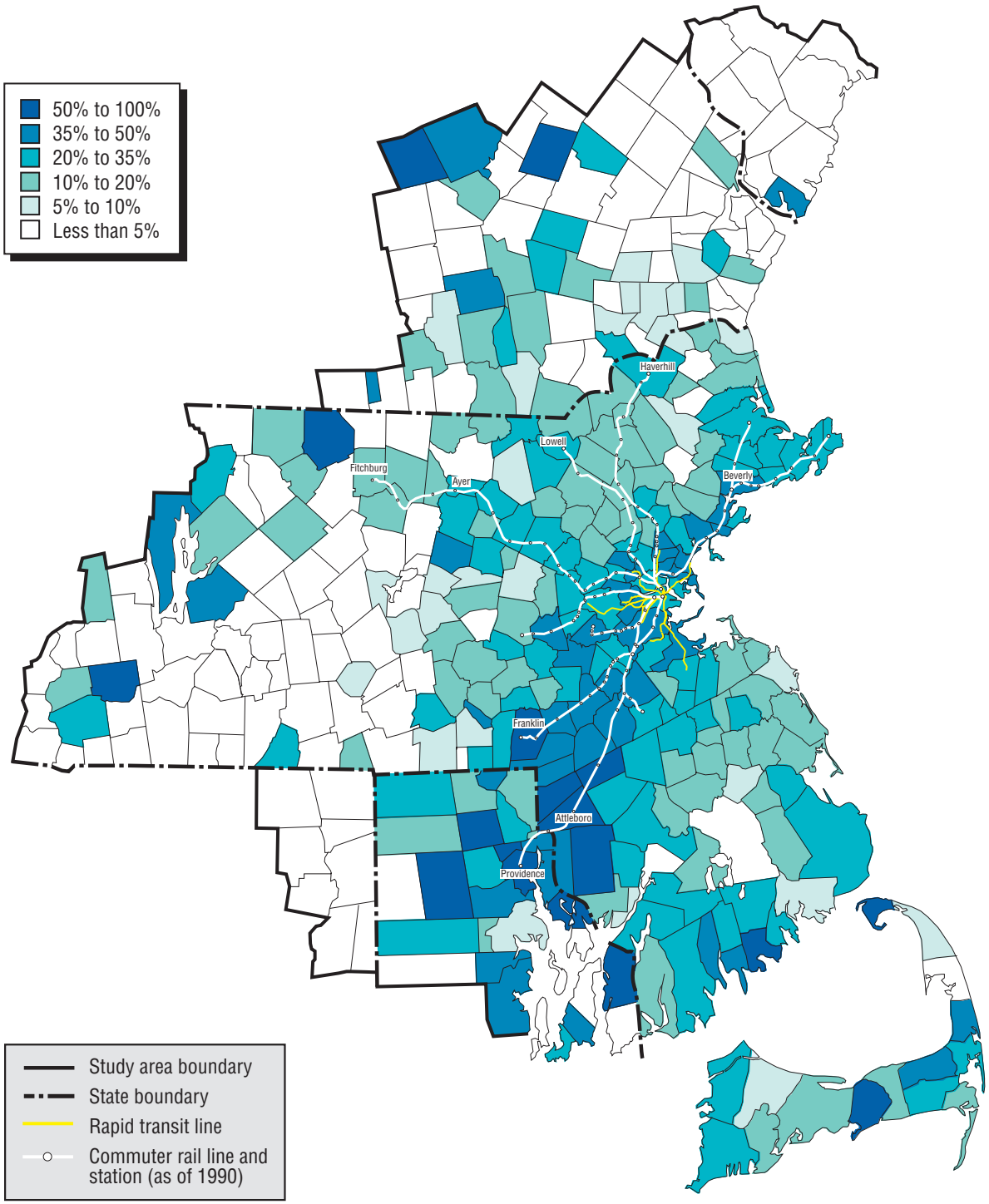
In other parts of the region, most of the decrease in transit mode share is due to declining bus ridership. This decline may be somewhat overstated, because bus ridership may have been artificially high in 1980 as a result of the 1979 oil crisis (see note below). Another point about this map is that declining or stable transit mode share does not imply declining or stable ridership. With the increase in urban core employment and its corollary increase in the number of commuters to the urban core, a stable or even slightly declining mode share could represent an increase in the number of riders, albeit a small increase relative to the increases in other modes. While the transit mode share declined by 0.9 percentage points between 1980 and 1990, the number of commuters using transit actually increased by 5%.

*Although the mode share for transit dropped slightly between 1980 and 1990, most of the large increase in the SOV mode share came at the expense of the carpool mode. In 1980, 15.8% of urban core commuters travelled to work in carpools, but in 1990, only 10.5% did so. Nationally, carpooling declined as a commuting mode from 1970 to the late 1980s and has stabilized since then, but the apparent magnitude of the decline between 1980 and 1990, and the corollary increase in SOV share during that decade, overstate the overall trend. In 1980, the SOV share was artificially low and the carpool share was artificially high because of the 1979 oil crisis, which caused a rise in the price of gasoline to a postwar peak of $2.50 per gallon (in 1998 dollars). After 1980, fuel prices dropped, and by 1990 the average price had fallen to $1.38 per gallon (also in 1998 dollars). This difference in price is likely responsible for about three percentage points in mode share, or slightly more than half of the observed shift. (For a more detailed analysis of this subject, see *Recent Nationwide Declines in Carpooling*, by Erik Ferguson, Ph.D. A.I.C.P., published in *1990 NPTS Report Series: Travel Mode Special Reports*, Federal Highway Administration, December 1994.)

†These large percentage shifts are mainly an artifact of the small number of commuters from these towns; even a small increase in absolute numbers is a large increase in percentage terms.

FIGURE 18

Percentage of Commuters to the Urban Core Who Use Transit, 1990



SOURCE: U.S. CENSUS BUREAU

The percent share of commuters who used transit to get to the urban core in 1990 is displayed in *FIGURE 18*. This map has several interesting features. The cities and towns immediately surrounding the core have high transit shares, as one would expect, given the high level of transit service provided by the local and express buses and the subway lines.* Some of the most distant communities also have high transit shares, reflecting strong patronage of private bus companies. For many of these people, such trips are too long to drive every day; buses offer a more relaxing and often cheaper way to get to the downtown area.

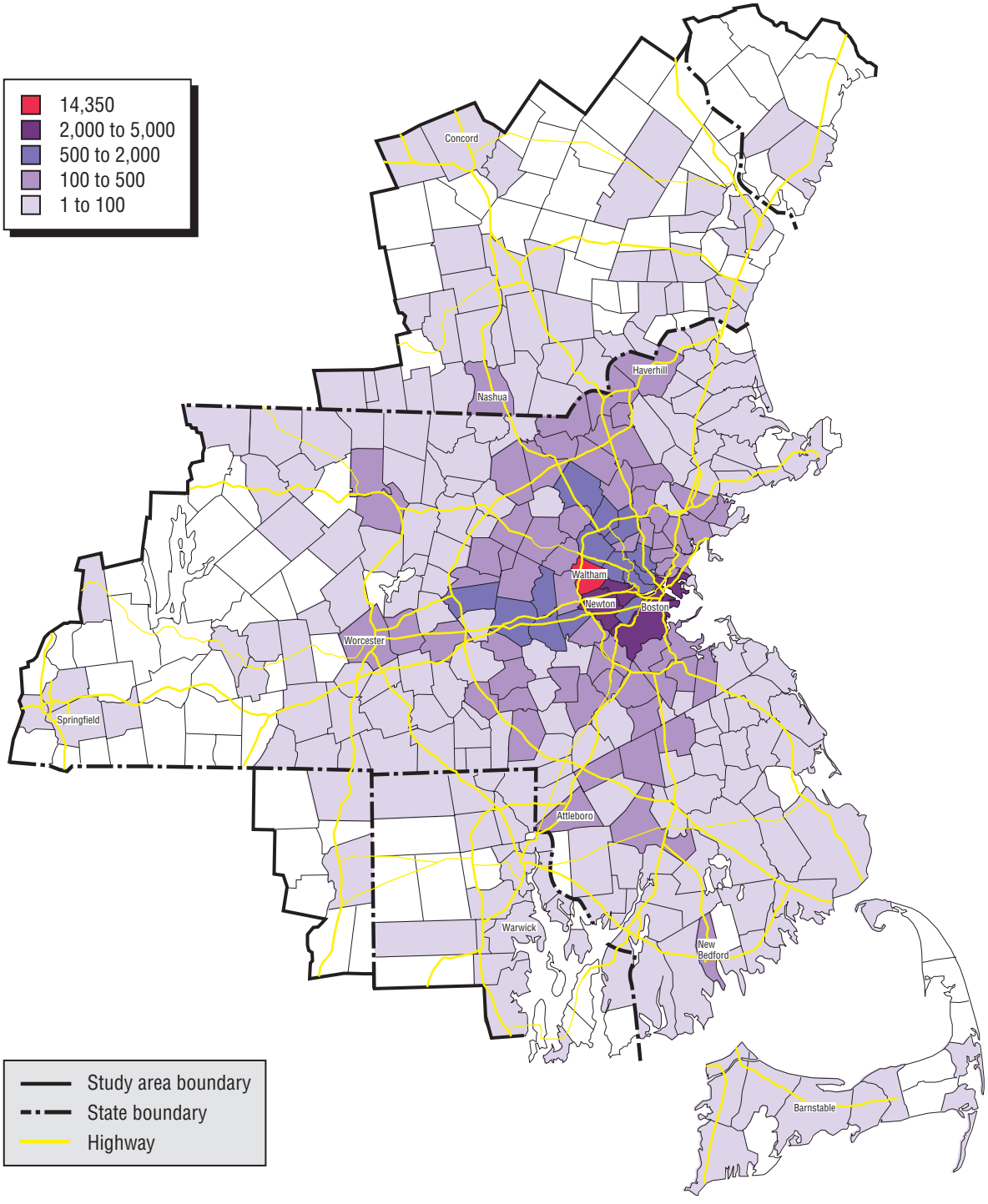
The effect of commuter rail service is clearly shown, particularly on the North Shore up to Beverly and—even more so—to the southwest along the Franklin line and the Attleboro/Providence line. In these two corridors (northeast and southwest), commuter rail offers travel times competitive with the automobile. On the Haverhill and Lowell lines, the terminal city has a high transit share while many of the intermediate communities have lower shares.

Areas in southeastern Massachusetts, including the Fall River–New Bedford area as well as Plymouth and several towns on the Cape, exhibit a moderate-to-high transit mode share because of private carrier express bus service.

*The urban core itself has only a moderate (30%) transit mode share, because a large number of urban core residents walk to work (35%).

FIGURE 19

Number of Commuters to Waltham, 1990



SOURCE: U.S. CENSUS BUREAU

Although the urban core has the largest concentration of employment in the MPO region, it provides just under 30% of the region's total employment. Much of the rest of the employment is located in suburban job centers along Route 128 and in other satellite cities.

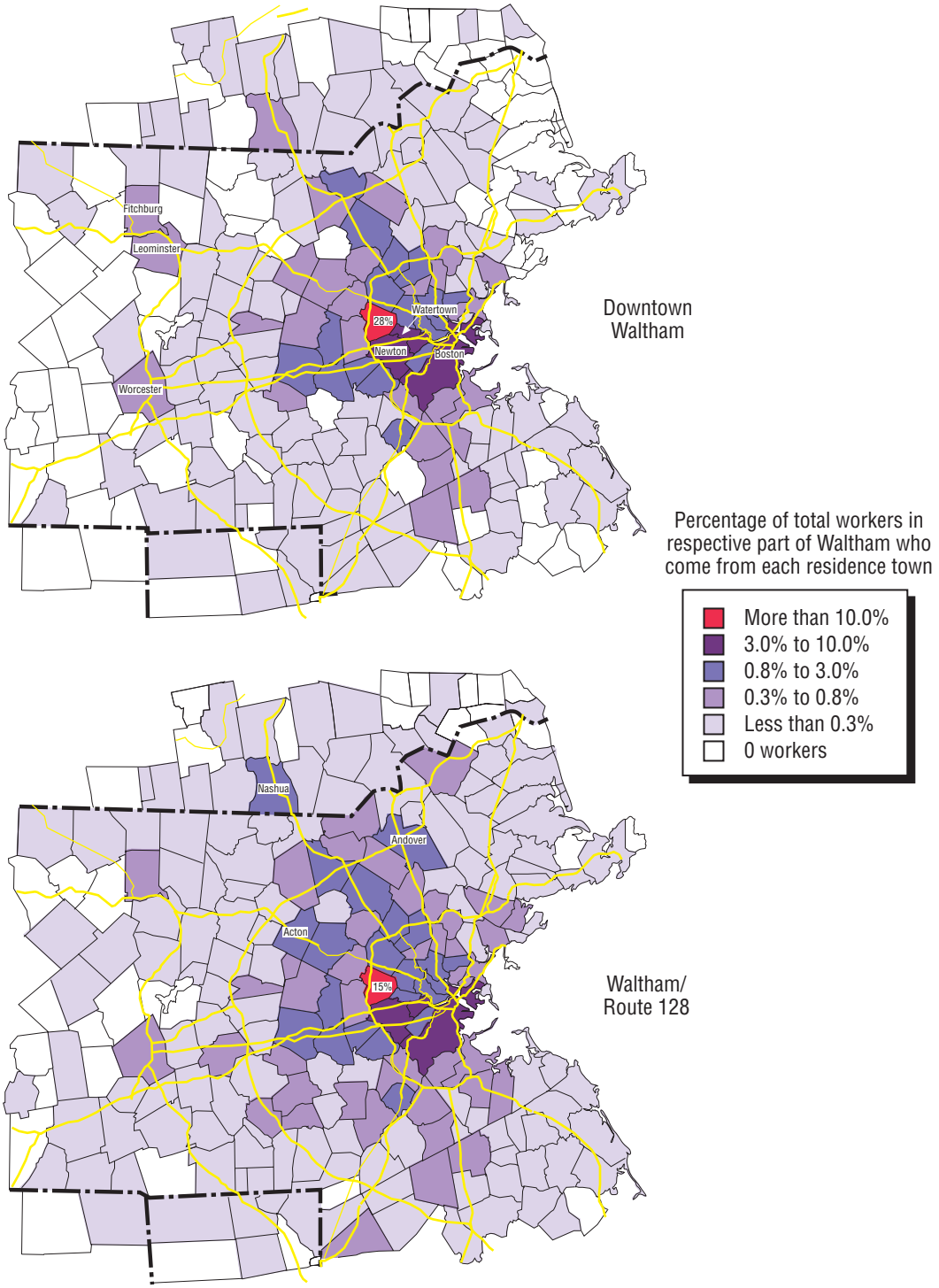
Suburban communities along Route 128 draw employees from a wide area in much the same manner as the core, but in lower total volumes. These characteristics constitute the basic problem in providing attractive transit services to and from these areas: although the geographical extent of the need for service is almost as large as for the core, the lower volumes are not sufficient to support frequent (and thus convenient) service. Two specific examples are Waltham and Burlington, which are large employment centers along Route 128. In addition, Lynn, an old city in its own right as well as a suburb of Boston, will be considered.

Waltham, which is the largest employment center on Route 128, has just over one-tenth the employment of the urban core (57,000 versus 500,000). However, as shown in *FIGURE 19*, Waltham employees travel distances nearly as long as those travelled to the urban core, with commuters coming from as far away as Concord, New Hampshire; Springfield and Barnstable in Massachusetts; and Warwick, Rhode Island. Cities and towns sending more than 100 commuters to Waltham are not quite as spread out, extending to Haverhill, Nashua, Worcester, Attleboro and New Bedford.

Waltham has at least two distinct concentrations of employment. Downtown Waltham is the older section, where the municipal offices and many retail establishments are located. This part of Waltham employs 14,500 people and is served by a commuter rail station and six MBTA bus routes. The newer employment center is located in the northwest section of the city along Route 128. This part of Waltham is home to many high-tech firms which sprouted in the early and mid-1980s. There is some transit service to "Waltham/ Route 128" (not nearly as much as to downtown Waltham), but as indicated by its name, there is excellent highway access. Over 24,000 jobs are located in Waltham/Route 128.

FIGURE 20

Downtown Waltham vs. Waltham/Route 128: Commuting Patterns, 1990



SOURCE: U.S. CENSUS BUREAU

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A comparison of commuting to these distinct parts of Waltham is instructive because it highlights the differences in commuting patterns between old and new employment centers. *FIGURE 20* shows the central portion of the MPO Commuter Source Area for both downtown Waltham and Waltham/Route 128. Rather than displaying the number of commuters from each residence town, these maps show what percentage of the total number of workers in each section of Waltham comes from each residence town. This method is called for to obtain a clear comparison since Waltham/Route 128 has nearly twice as many jobs as downtown Waltham.

One can see that the commuting pattern for downtown Waltham is more concentrated than that for Waltham/Route 128. For downtown Waltham, the city itself houses 28% of its workers, while another 18.5% are housed in the neighboring communities of Boston, Watertown and Newton. All of the other cities and towns with more than 0.8% of downtown Waltham's employees are within the Route 9/ MassPike corridor to the west and the Route 3 corridor to the north. Those with between 0.3% and 0.8% do not extend much farther, except for old cities to the west with historical links to Waltham, namely Fitchburg, Leominster and Worcester.

For Waltham/Route 128, only 15% of the workers live in Waltham and only 14.4% live in Boston, Watertown and Newton. Cities and towns with more than 0.8% of Waltham/Route 128's employees extend significantly farther, compared to downtown Waltham's pattern—north to Andover and Nashua and northwest to Acton. The next-lower category is also more spread out in all directions.

Waltham/Route128's high-tech orientation may partly explain why it draws employees from greater distances than downtown Waltham. Because high-tech jobs call for specialized skills, these firms must draw from a very large labor pool, including people in other New England states.

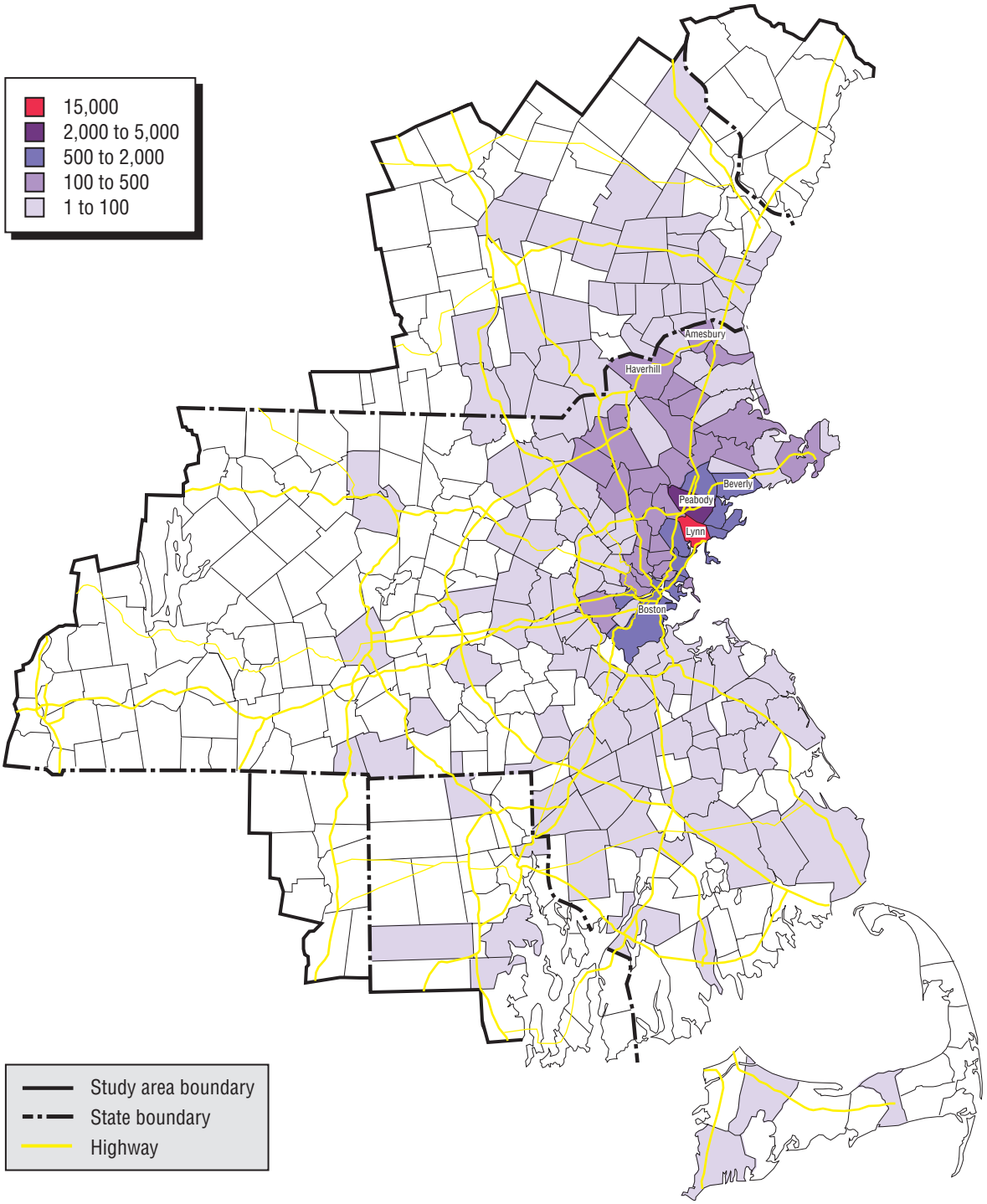
Beyond the commuting patterns, there are also differences in the modes chosen by commuters to the two sections of Waltham, as shown in the table below:

Mode	Downtown Waltham	Waltham/ Route 128
Drive alone	75%	88%
Carpool	13%	9%
Transit	3%	2%
Walk	8%	0.3%

These mode shares reflect both the fact that Waltham/Route 128 employees are coming from longer distances and that the development style in Waltham/Route 128 is automobile-oriented—spread-out, isolated office buildings surrounded by parking lots. Downtown Waltham, in contrast, is more urban in its development style—with a close clustering of buildings and less parking—and is thus more conducive to transit and pedestrian travel.

FIGURE 21

Number of Commuters to Lynn, 1990



SOURCE: U.S. CENSUS BUREAU

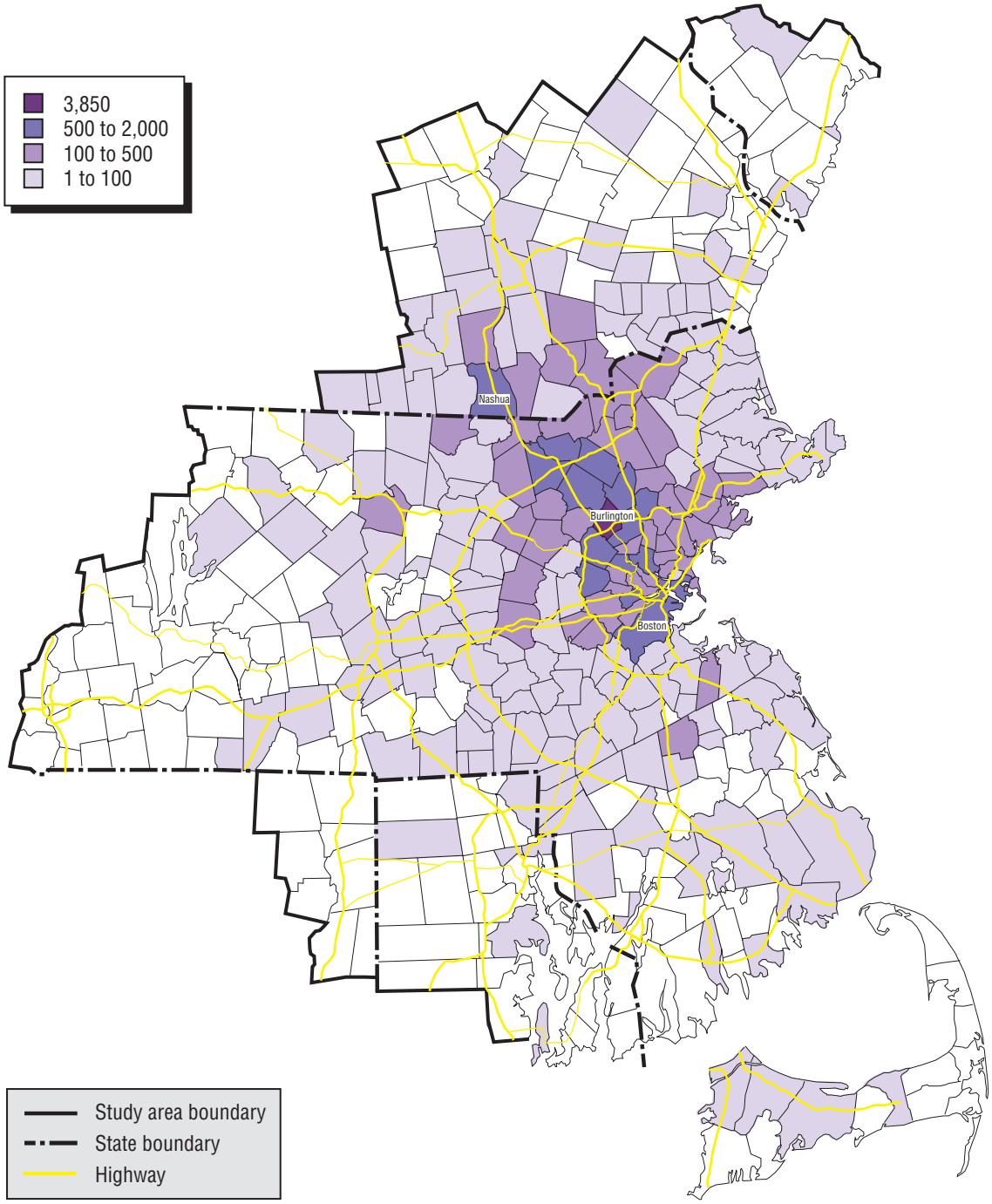
Another comparison of old and new is afforded by the city of Lynn and the town of Burlington. They have roughly the same number of jobs (Lynn—33,600, Burlington—31,700), but they have strikingly different commuting patterns, demonstrating in a more obvious way the differences between downtown Waltham and Waltham/Route 128.

Lynn is an old city whose largest employer, General Electric, has operated a plant there since the early part of this century, manufacturing heavy equipment such as steam turbines and jet engines. Employment in Lynn has been declining for several decades, and there is very little new development there. Lynn has a large population (81,245) and a balance of jobs and housing (0.97 jobs for every housing unit).

The commuting pattern for Lynn, shown in *FIGURE 21,* is relatively compact. Of the workers in Lynn, 45% reside in Lynn itself and an additional 18% reside in the surrounding five communities, including Peabody, with more than 6% on its own. While there are some far-flung communities that send small numbers of workers to Lynn, the cities and towns which send more than 500, from Boston to Beverly, are within a fifteen-mile radius, and virtually all of those which send more than 100 are within twenty miles, Haverhill and Amesbury being the exceptions. Mode shares among commuters to Lynn are very similar to those for downtown Waltham: 75% drive alone, 11% carpool, 4% use transit and 7% walk.

FIGURE 22

Number of Commuters to Burlington, 1990



SOURCE: U.S. CENSUS BUREAU

Burlington is a recently developed town with a major retail area and a large amount of development located around Route 128 in suburban-style office parks. Much of the office space built in the 1980s is occupied by high-tech firms. Burlington has a much smaller population than Lynn (23,302) and a very high jobs/housing ratio (3.96 jobs for every housing unit).

Burlington's commuting pattern is shown in *FIGURE 22*. Compared to Lynn's, it is far more spread out. Indeed, although Burlington has far fewer employees than Waltham or the urban core, it draws commuters from distances nearly as far. Only 12% of Burlington's employees live in Burlington. While the six surrounding communities house 18% of its workers, which is similar to Lynn, there are many more communities at greater distances housing large numbers of Burlington workers. To encompass all the cities and towns with at least 500 commuters, one has to go to a twenty-two-mile radius, and for towns with at least 100 commuters, to a thirty-mile radius. From Boston to Nashua, there is a steady line of moderate concentrations of Burlington workers, with no high concentration anywhere. The mode shares of Burlington commuters are very different from Lynn's and very similar to those of Waltham/Route 128: 88% drive alone, 9% carpool, 1.5% use transit and 0.5% walk.

CONCLUSION

This study has illustrated many of the factors which have shaped the way people in the Greater Boston area commute. The dramatic shifts of population since 1950 and the growth in suburban employment over the past two decades, both facilitated by the construction of the regional highway network, have changed the face of the region. Farmland surrounding the old urban centers has been transformed into suburbs, and Route 128, known in the 1950s as the "road to nowhere," now carries hundreds of thousands of people from suburban homes to suburban offices.

One of the alleged benefits of locating offices in the suburbs was a reduction in the length of commuting trips, since most employees were presumably living in the suburbs. The high percentages of imported workers at recently developed suburban job centers, however, indicate that the relocation of jobs does not necessarily shorten commutes. The true impact of the suburbanization of jobs is that it is possible for a suburban worker to live in towns farther removed from the core than an urban worker could and still have a tolerable commute. As was shown in Figure 9, towns outside of Route I-495 have low housing prices and thus are attractive for suburban workers. It seems clear that suburban economic development is part of the cause of the continuing spread of population to the edges of the metropolitan area.

Increasing numbers of people are choosing to live far from the core, whether they work in a Route 128 job center or in Boston. While commuters to the urban core have a choice of driving or using mass transit, though, most commuters to suburban workplaces have little choice. Highway space is limited and, with the long commuting distances, many miles are being travelled. This has led to congestion in the suburbs that approaches the severity of congestion in the core area, even though the employment level in any one suburb is well below that of the urban core.

There is no clear solution to the problem of suburban congestion. In some cases, expansion of capacity on existing highways can improve travel conditions in specific areas. To the extent that such expansion spurs new development, however, the congestion relief will be short-lived. It is doubtful that conventional transit could ever capture a large share of commuting trips to suburban workplaces; the convenience and time savings of driving and the availability of free parking are huge obstacles for transit.

In the short term, marginal reductions in suburban congestion can be achieved through transportation demand management efforts such as ride-matching, shuttle routes to transit stations and other commuter services. Employers can promote commuting options for their employees by working individually with CARAVAN for Commuters, Inc., or collectively in transportation management associations. Telecommuting may also play a role in reducing the number of peak-period trips taken.

In the longer term, better land use planning—sometimes known as "transit-oriented" or "traditional neighborhood" development—could help to reduce the number of vehicle-miles travelled. This type of development includes revamped zoning codes that allow mixed land uses in a mid-to-high-density, pedestrian-friendly design. Suburban offices, specifically, would be encouraged to locate in areas accessible by transit and would no longer be required by code to provide large amounts of parking.

Congestion will never be eliminated entirely; it is the price we pay for living in an urbanized area. Land use and transportation policy, however, should be geared toward allowing people, and even encouraging people, to choose their residences and workplaces so as to conserve energy, preserve the environment and avoid spending their time stuck in traffic.